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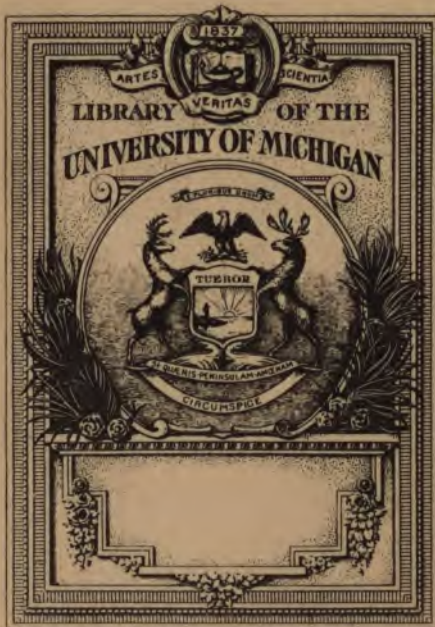
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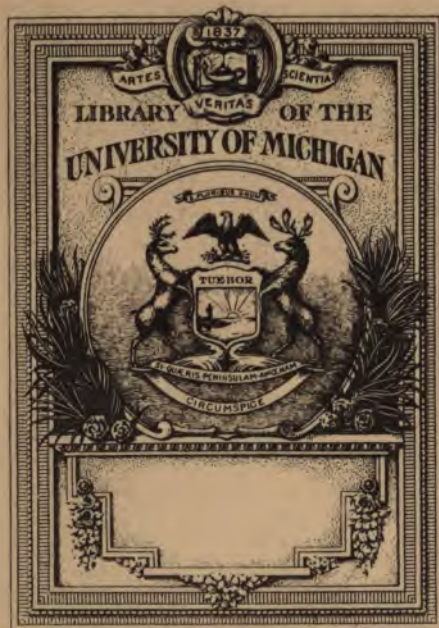
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THE NERVOUS SYSTEM OF THE CHILD
ITS GROWTH AND HEALTH IN EDUCATION



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A Bibliography of Reports, Lectures, and Papers relating to the Scientific Study of Children, with reference numbers, is given on page 217.

THE NERVOUS SYSTEM OF THE CHILD

ITS GROWTH AND HEALTH IN EDUCATION



BY

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PREFACE

AT the close of the nineteenth century, as we review the progress that has occurred in the conditions of social life and the trend of public opinion and thought, we cannot fail to be impressed with the greater refinement and humanity in the management of children, and the increasing appreciation of the real value of the mental aspects of life. Most of the great achievements of this century have resulted from the increase of exact knowledge and the application of scientific principles to the objects to be obtained. Perhaps in no branch of study has more activity been displayed than in that which concerns mind. Especially has much been accomplished in that part of this study which deals with the evolution of brain action as observed in the child. Recent advances in this direction have made it possible and desirable to adapt those methods to child-study which have been employed in physics, biology, natural history, and medicine; *i.e.* methods of observation, description, and inference. I think there are a great number of readers and students who desire to obtain a real grasp of the great problems concerning the relation of mind and body in the child,

and following scientific principles are willing to work diligently to the attainment of that end. For this purpose they must know what to look at and what to look for in the child, as facts to be studied and aids to sound conclusions. Many students feel the need of knowing more of the character and significance of the phenomena they observe, which are often obscure in their origin, and desire to understand more about what they can see as definite facts. They desire—and rightly desire—to understand something of the mental attitude of their pupil corresponding to some distinct visible act. And, certainly, not to follow the workings of the child's brain, is to risk losing opportunities of rendering assistance in the formation of character, and may lead to grave mistakes in education.

This book is addressed to that large body of earnest workers for the welfare of children which is seeking for knowledge of facts and principles in harmony with the best wisdom attainable as to the mind and body of the child. To you who are engaged in this study scientific methods will afford something permanent in your work; an inquiry followed out with intelligent purpose will give experience grounded on a sure basis. Dignity and success are added to the duties of caring for children by some employment of scientific methods of gaining knowledge. A mere rule of thumb experience, valuable as the outcome of dealing directly with

individual children, may be rendered doubly useful when directed by a deeper scientific knowledge, such as will place the phenomena of child life in their proper place among the facts of nature, and show how far it is wise to adjust environment to the child.

The study of children, and a knowledge of the nervous system of the child and of the best means of promoting its health and training, concern parents, teachers, and members of the medical profession, each in their several relations. I trust that this work may lead to the harmonious action of all three classes in education, and in scientific study.

Children are here for the most part described in relation to the school and to education rather than to the family. Individual children are described, as well as natural groups and their peculiarities, much stress being laid upon the study of observations. While thus adapting the work to the needs of teachers in day-schools and boarding establishments, it has been necessary to touch upon many considerations of hygiene; in such matters the advice and assistance of the physician is often necessary. In addressing this book to teachers I have endeavoured to indicate distinctly where help is required from medical science; as the opportunities for useful advice from the medical profession increase, it is necessary that there should be a common understanding as to the terms to be used in the description of the conditions of childhood. For these pur-

poses we must practise methods of observing children and making scientific inferences from what we see.

Many medical men are now concerned with school work as managers or medical officers, or in other ways intimately associated with the care of children and their education. It appeared convenient to adopt the plan of addressing teachers rather than parents and medical men. Not to burden the reader with technical matters of purely scientific and medical interest, references are given to reports and papers previously published, some of them statistical in character, which afford further explanation of the diagnosis, as well as methods of treatment, which could not be given in the compass of this volume.

Mental study, pursued in a scientific spirit, must be founded on observations, and inferences drawn from them, as to the modes of brain action corresponding with those observations. In a former volume I have dealt at length with the methods of observing children; here the experience gained is put before the reader with ample references to the observations on which it is founded. Still the student should learn to observe and describe what he sees for himself; otherwise he may simply receive dogmatic instruction, and fail to acquire progress in scientific thought and practice. General modes of brain action, indicated by visible movements, may easily be perceived, and their observation recorded in accurate detail. Methods of classi-

ying observations will be readily appreciated by the student of natural history; these classified observations amount to scientific descriptions of children, and we are thus enabled to follow with accuracy the mental conditions produced successively under the influence of education. As we proceed by the methods employed in science and in clinical medicine, the need of mental as well as physical hygiene in the training of children will become apparent. Passing under consideration the stages of evolution in the child from infancy to adolescence, we shall by employing these means obtain insight into the proper management and training of children.

My thanks are due to Dr. Wm. B. Dove for much assistance in correcting proofs and in preparing the index.

F. W.

5 PRINCE OF WALES TERRACE,
KENSINGTON, LONDON, W.

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THE NERVOUS SYSTEM OF THE CHILD



CHAPTER I

INTRODUCTORY

THE children are the mainspring of life and interest in the home and in the school; their demands are many and urgent, raising feelings in us of affection, and many thoughts as to their well-being in childhood and in the future; they awaken a sense of our responsibility towards the individual child, as well as to others, in as far as his future life and action may depend upon the wisdom and acquired experience which we bring to bear on his health and training.

Such responsibilities begin in the family, where others besides the parents have an interest in the child, and duties to perform towards him. The well-trained infant is likely to become an apt infant-school pupil; and so throughout the early years, stage by stage, the child forms a centre of interest and duty in many and varied aspects.

Still, it is a fact that children bring troubles to those around them, and much weariness in labouring for their welfare. Such feelings should, in response, awaken your efforts and the desire for further knowledge of child-life, and of understanding the dawn of mental aptitudes, which sometimes appear conflicting as seen in the child's feelings and modes of response towards those around. Such facts, if looked at without understanding, are apt to lead to regrettable mistakes. Why does the infant cry? What does he want? Only our observation and experience can give an answer. So in the infant school, "Why will not the children stand still?" We shall see further on that spontaneous movements indicate the most hopeful conditions of the brain for the future.¹

To the question, "Why does not the child understand what I say?" it may be replied that perhaps your words raise no impressions in his mind because the necessary training has not yet been received.

To trace out the meaning and the origin of our difficulties in dealing with children will give a new pleasure to the work, and enable us to plan in our own minds what to do, adding an intelligent interest to daily duties in the care of children of any age. (See Chapter VII., p. 147.)

The student of childhood has a large field of observation open to him. To know the mind of the child, and to trace out its developing faculties, necessitates much

¹ "Mental Faculty," pp. 24 and 68. The Macmillan Company.

attention to child-study; and this, I think, should commence with observation of the child after the methods of natural history; describing what we see, classifying our observations, and making inferences as to what is going on in the body and in the brain of the child before us. This power you will attain for yourselves by practice, with some understanding of what is occurring in the brain of the child before you, while you learn to adapt your methods in training to the conditions of the child and your own aims for his welfare.

The class teacher, with his pupils before him, can look at each, and if he knows what to look for, he will be able to follow the changing brain moods of the pupil, watching the impressions the pupil receives from instruction, their interaction, and the final outcome in expressing mental abilities or faults.¹

The principal of the school needs to know each pupil sufficiently for the purpose of classification, and must readily appreciate character and mental abilities or disabilities. Such rapid observation affords a basis of reasonable knowledge, which, when combined with experience, will suggest the best means of meeting the difficulties that arise with every child.

The training of a child, the management of a class, and the arrangement and control of a school demand knowledge of the individual pupils and the formation

¹ Reference 49.

of a rapid opinion of each from observation with inferences founded thereon. The conditions of each child, not merely the rules of the school, should help in forming a judgment of conduct. Does the pupil forget the lesson he learnt over night, or bring up a sum very incorrectly worked out, it is necessary and very interesting to analyse and follow out the causes of the success or failure; the faults may be in the child's brain while doing the work, as well as those due to want of accurate impressions received in previous training. (See Chapter X.) If you study brain action as well as the mind, you may observe what goes on in the child while under your guidance, and also when he is alone and self-controlled in his work. Child-study will give an interest to the life of the teacher who trains himself to observe and intelligently traces out what takes place in the pupil. This will add power and dignity to his work.

In caring for the young you should never fail to consider the antecedents and the consequences of the present surroundings of the children;¹ the past tells upon the present, and the present controls the future—as is commonly said, the child is the father of the man.

A healthy brain in a healthy body is what we want to cultivate in the child (see Chapter IX.); the brain and the body are mutually dependent on one another,

¹ Effects of overcrowding, etc. References 10-12.

and without the health of each, mental power and activity will run low. The brain is the physical basis, or seat of mental action such as is expressed in gesture, movement, or by spoken or written words; further, the action of the brain gives vitality to the body, controlling its nutrition as well as the processes of digestion, respiration, and circulation. Thus, a healthy condition of the blood demands proper feeding and digestion, while for its purity it requires oxidation (see Chapter VI., p. 127); exercise with walks and play in the sunshine quickens a healthy circulation, both in the body and the brain, supplying them with the necessary food and oxygen; light and well-ventilated rooms being necessary for the same reason. (See Chapter VI. p. 122.) Physical exercises, drill, and gymnastics aid development of the chest and lungs; also tending to strengthen the growth of the heart. The brain acts upon the body; its disorderly action may cause dyspepsia, palpitation, and breathlessness; liability to nervous disorders often results from want of early discipline in well-regulated modes of brain action, and training in those systematic modes of mental procedure which might save the child from too much emotion followed by fatigue and exhaustion. The young person who is allowed to grow up without good and established habits, is liable at adolescence to excitement, emotion, restlessness, and is apt to suffer from consequent palpitation, dyspepsia, and prostration,

which early and continuous culture might do much to prevent.¹

The brain receives impressions through the senses, while other activities in it appear to be spontaneous. In training and in teaching we endeavour to produce impressions in the brain; some directing, guiding, and controlling the natural spontaneous activities, while others are designed to produce the special action which we wish. When showing an object, you may make the child look at it, and feel it, both as to its size and its weight; thus impressions are produced in his brain. When he asks "What is it?" you couple the name with what he sees; then as he feels the weight, you name that impression as "heavy." Such training by physical impressions should, I think, precede any attempt in giving descriptions and making comparisons; impressions must be received accurately in the brain before they can be compared. The child can associate "heavy" with the feeling of an iron weight in his hand, and "light" with the feeling of an empty pill box. Later on, after he has gained experience, he will be able to compare the weight and the box.

These considerations as to the relations between mental action and the brain on the one hand, and the body on the other, lead me to speak of the Hygiene of School Life in its physical and mental aspects; these subjects will be dealt with in later chapters.

¹ Reference 27.

School Hygiene is generally understood to describe the means of cultivating bodily health, and avoiding the illnesses and diseases common during the period of childhood, especially those that are preventable, such as diphtheria and the infectious fevers. Mental Hygiene can hardly be said to be established as a science, yet many facts have been accumulated available for the purpose.¹

The school aspect of childhood is naturally that of success in acquiring knowledge, and learning the subjects taught; while the development of brain power and character is also aimed at. Other aspects of childhood may also be kept in view; child-study will throw much light upon educational problems and questions that sometimes arise, as between the home and the school.² Teachers see the child in the school in the morning, fresh and active, when he may be quick, eager, and conscientious in work; the parents see him at night, tired, peevish, and fretful, as well as disinclined for either food or rest. Observation might soon show at what period in the day fatigue signs commence, — when, though mental work continues under the stimulus of school surroundings, the brain nutrition begins to decline. The brain is a sensitive organ, it performs much work in the body; it is dependent for

¹ Reference 9, "Milroy Lectures," and 48.

² See author's "Study of Children," Chapter XIII. The Macmillan Company.

healthy power upon the food it receives through the blood, and becomes fatigued after receiving many impressions continuously through the hours of work; this will be described further in the next chapter.

A child sometimes looks full under the eyes, with a lack of expression and lassitude on entering the schoolroom, signs which may pass off during a healthy, well-regulated day's work and play, while inquiry shows unhygienic surroundings in the home life.¹ Some physicians have said that all young children are delicate—they speak from experience limited to their patients; some head-mistresses have said that girls can study as hard as boys; inquiry, founded on observation, demonstrates that delicate or ill-developed girls are more apt to suffer in health from adverse circumstances than boys similarly constituted.²

Child-study, leading to description of the children as we see them, enables us to make classifications in many groups according to the purpose in view. We may take a group of children all found to be delicate, and study their brain conditions as described, and their mental aptitudes. One hundred children may be selected as dull or below the average in mental ability;³ results of observation will show a certain proportion

¹ Reference 29.

² See "The Study of Children and their School Training," p. 245. The Macmillan Company.

³ References 15, 41.

who are also delicate, especially among the girls; further, it will be seen that most of these children present irregularities in movement and action, which can be removed by good training with the probability of improvement in mental ability. Many causes of mental dulness are removable. Many varieties of children will be met with, and may be described, either as to their mental abilities, or as to the points observed in their health, physiognomy, development, and the nerve signs seen in the movements, which indicate the action of the brain. When a child is observed and studied in each of these ways, a description is obtained, showing much of the visible indications of the state of the brain and its mental functions.¹

Training is a responsible work; each child should be known to the teacher as an object of study. The action seen in a child may admit of different interpretations; his movements may be due to much spontaneity, or to the restlessness of fatigue. The practice of accurate and scientific observation is a responsibility and a duty. When the teacher knows what to look *at*, and what to look *for*, a rapid and correct opinion will be formed in class work; whereas sometimes regrettable mistakes result from guessing as to why a pupil does not do what we think right. Points for observation in children will be given in Chapters II., III.

It will thus be found often — not always — that the

¹ Reference 32.

boy with ill-moulded features, and small eyes and mouth, who is slow and inexact in his movements and response, is also usually dull in mental work.¹ The girl small in build and in head, with good features, changeful expression, and quick response in movement, is usually bright in class; but apt to be delicate, and often disabled. The types and varieties of children are endless, yet all need care and training; hence child-study is essential to the teacher, that he may understand the pupil before him, and do his best according to experience.² In the same class one pupil must be urged to quicker response; another to be more deliberate and to pause to think; a third to look before he speaks.

Training and guiding brain action and mental action should precede instruction, and is the principal object to be aimed at in the earliest years. I here distinguish between training and instruction, or teaching. We train the pupil to look at objects, to make a choice of one, to feel it both as to its weight and its size; we make him feel it in various ways—thus producing impressions on his brain. We teach him the numerals, and train him to count objects as he looks at or touches them, before teaching the use of figures for numbers. We train the child to feel weights, 1 oz., 2 oz., 4 oz., and teach him the number which expresses each weight; we make him feel the 2 oz., then the 4 oz., and teach him that the latter is twice the former weight; later he is

¹ See "School World," Macmillan. Reference 47.

² Reference 8.

taught multiplication, proportion, and other modes of comparison. (See Chapter VII., p. 155, and X., p. 199.)

All training should bear on the future, and be conducted stage by stage, with the object of educating brain action and its faculties for mental work. Much of this training may be effected without many words; whereas knowledge is generally imparted to the child by verbal teaching, when each word must be understood before accuracy in mental training can follow.

We all know that physical exercises, marching, organized movements, and games are useful in training young children; they influence the brain action by guidance. These exercises are not said to give knowledge or to be understood by the children, although they are acted out and remembered, becoming more exact by practice and more readily performed with less guidance; but one advantage of physical exercises in brain training is that they can be employed before words of direction are understood by the pupil. With nervous children it is sometimes useful just to get them to perform the exercise and make the movements required, so avoiding all chance of exciting the child by talking much to him.¹

Training is needed to cultivate the general character of brain action, bringing its spontaneity under temporary control (inhibition, see Chapter II.), producing repetition of action with some accuracy (retentiveness or memory), and imitation of the teacher. Training is also

¹ Reference 27.

necessary to enable the pupil to retain and reproduce his impressions in their order; that is to say, they should easily hang together or become coupled in the order in which they were received, such as repeating a series of acts as taught, and in naming objects in the order in which they were seen. He should learn to distinguish what he sees from what he feels; colour, size, as apart from weight, length as apart from bigness. Later on he should be trained to remember, and subsequently to name and compare, lengths, sizes, and weights. All this makes a basis for understanding arithmetic hereafter. (See Chapters VII., p. 146, IX., p. 180.) All children need cultivation of good speech and pronunciation; for this purpose the child must learn early to look steadily at the action of the teacher's mouth, in making elementary sounds and in articulation.

To understand and remember a map, the pupil must look all round the outline, along the course of the rivers, and at the points which represent the site of towns. He must associate looking up the map with "North," looking to the right with "East" etc. The proportion in distance between the dots representing towns, and lengths of portions of the coast, or boundary lines, can only be appreciated and remembered after training and practice.

Observation of the individual pupil should precede and accompany his training;¹ if young, and full of

¹ "School World," Reference 45.

spontaneity, as yet uncontrolled, you want to know whether he is best guided by the spoken words of direction, or through your gestures, pointing, and imitation; for children vary much in these particulars. He will stand and move as he sees you do, and look towards what is pointed out, and then name it as he looks at your face. He will examine objects or count them as he sees you do, and in feeling them, receive impressions of length, size, weight, by his senses and the muscle-sense of which I shall have a great deal to say. Though there be much restlessness, and a tendency to chatter, he may imitate your quiet action; if he never pauses to think, you may arrest his spontaneity, momentarily after a question, by your attitude before allowing a reply. When the sum in addition is inaccurate,¹ see whether the difficulty arises (1) in looking accurately at the figures in the column or (2) in adding the units, or (3) in setting down the total and carrying; these are three different brain processes. (See Chapter IX., p. 184.) Observe any signs of extra brain action or superfluous movements the while; do his fingers twitch on the pen, do the muscles of his face work; are the eyes moved regularly; is the tongue protruded at each fresh effort; are any signs of fatigue to be seen? All these manifestations will be described in a later chapter.

¹ See "Study of Children," Case 2.

Class training calls for rapid observation and inference; a mode of action often spreads quickly among children, especially laughter among those somewhat of the nervous type, by imitation. The teacher's action, modes of expression, and method in work, impart training and knowledge to the pupils; at the same time an efficient teacher receives, it may be unconsciously, many impressions from the class with which she is in sympathy; favourable impressions may even be imitated by the teacher from her pupils. Thus, the teacher controls the class, and the children react upon the teacher. This adds much to the moral responsibilities of class teaching. I have often seen the signs of fatigue, attitudes and indications of lassitude, imitated by boys and girls from a teacher who might by a voluntary effort avoid any expression of weariness, just as any tendency to impatient words and gestures is suppressed voluntarily.

Control of the school demands that the principal should be possessed of experience with a large grasp of the objects of education, and the abilities and disabilities of children; no aspect of childhood should be unobserved by the manager:¹ for, except where the school is a small one and the pupils are selected as suitable to its constitution, the requirements of all sorts and conditions of children call for due consideration. The Hygiene of the schoolroom forms an important

¹ Reference 50.

item in management, of which some details will be explained later on in Chapter VI.

It is mainly of Mental Hygiene, as dealing with the mental abilities and disabilities, that I now propose to speak in relation to school management; because this may, I think, assist in bringing together the class teacher and the principal in the work of organising the classes and the school.¹ A pupil good at class exercises in reading, history, mental arithmetic, and geography may be most inaccurate in transcription and spelling; consultation might show that he has good mental power and memory, but that he is short-sighted; or more likely inexact in eye-fixation, so that he does not see words exactly. This is a common cause of such difficulties, needing eye-drill, of which I shall speak presently. If the school is a mixed one receiving boys and girls, some rules of discipline cannot wisely be enforced in all cases; while the boy with headaches and sleeplessness or debility may stand some strain, there is apt to be more danger under these conditions for the girl, if required to work beyond her strength.² Here observation and experience will indicate the exceptional cases where rules would be wisely relaxed. Organisation of the classes may include pupils of about equal age and mental ability; they

¹ Reference 49.

² Recurrent headaches. See *British Medical Journal*, 1879, Dec. 6, and "Brain," 1880, Part XI., and Reference 51.

will, however, vary much in disposition and methods of work. This is probably for good. Children of the nervous type are gregarious; it is well that they should associate with others of more stolid type, and, it may be, slower in mental action. The class may show a tendency for too much laughter, a spirit of criticism of the teacher, in which the pupils emulate one another, some display of vanity or other form of emotion; too much harmony from mutual imitation, calling for the association with children of more varied type. Some child-faults are difficult to understand. A boy secretes things belonging to another, he does not use them, and when detected denies the act; such cases sometimes depend upon 'petit mal' or slight epileptic attacks; the family history will probably afford some explanation. Mental confusion is often caused by the occurrence of spontaneous thoughts, and these are frequently accompanied by spontaneous movements which you can observe; the brain then needs training to more methodical action. Mental confusion may be due to many other causes, which we shall consider presently.

Cultivation of healthy mental habits should begin early in training the brain, before the use of words; all that makes for the health of the body, aids growth and future power of the brain; air, light, feeding, and personal comfort in the surroundings. General liveliness and healthy spontaneity may be encouraged by

management of the infant, while regularity in the times of attention to all his wants, and the times for sleep and out-door airings, prepare him for methodical occupations later on. Early training of speech, commencing with the elementary vocal sounds, may be tried in the second year. The little child must be made to look at your face, and particularly at the mouth as you make the sounds he is to imitate; then any power acquired in fixing his eyes on an object for a moment enables baby to see the mouth in movement, which he partially imitates; this action in his brain becomes coupled with the impression of the sound heard, and the expression of the face seen. The baby grasps objects with either hand, and with the two together; things that are heavy soon fall, thus he receives many impressions on his brain produced by sight, sound, and feeling, such as are afterwards employed in making comparison. He may soon be controlled in imitating some of your movements, though spontaneity continues marked the while in parts not thus engaged. Any attempt at control is very likely to be followed by some spreading action, as, a smile in the face, or movements in the hands and feet; at sight of you as you speak he may move all over.

In the child's third year you acquire more control over his brain action; he has more power, and holds up his head and puts forward his hand and moves it up and down as you do, once, twice, three times.

His movements at first will not exactly resemble yours in the regularity of time or degree of action; only in number. You need not try to teach the numerals as names; but even thus early you may produce impressions on his brain for a moment or two, which will be useful afterwards in training him to count. So also colours may be shown without being named, his brain is impressed through his eyes, but we do not want yet to elicit any choice, comparison, or expression. (See Chapter X., p. 205.) We do not require many names for things or for expression, rather a few terms for direction and control, such as "sleep," when he is laid in bed comfortably; "quiet," as he sees you are still; "good," when you are able to smile at him.

Still much remains to be attempted in training before the regular occupations and teaching of the kindergarten or infant school commence; spontaneous activity should be increasing, leading to many impressions as the eyes are directed to objects, things are felt having size and weight, actions in other persons are seen, and many words are heard. Moreover, such spontaneity indicates the activity of the brain which will shortly become capable for the expression of organised thought. In advancing the training afforded, stage by stage, exactness in action as to time, sometimes uniformly repeated, at other times varied, brings the brain under control through the senses, leading to the growth of those characters of brain action which

are necessary to mental processes, as will be further explained. The child's brain is thus prepared to perform the actions that are required when teaching him.

As the child grows, many impressions may be produced and associated with words; terms are wanted, available as directions for acts: "sit," "stand," "throw the ball"; names of colours, and the feelings associated with "light," "heavy," "short," "long," etc. Also as to movements of the eyes and hands, "up, down," "right, left," and in many other matters; as you pronounce a word the child tends to repeat it. (See Chapter VIII., p. 170.) Training should precede instruction, but needs to be continued along with it, as controlling brain growth and organisation, and producing the impressions dealt with in teaching. Thus training in regular and uniform hand movements forms a basis upon which you proceed to teach the numerals in counting, and makes the child *feel* that ten movements are greater or more than one. So, training to move his eyes and to count enables him to count at sight, while the use of numbers as expressed by the numerals gradually becomes familiar and understood before figures are used as symbols in arithmetic. Again, training the pupil to feel weights in his hand enables you to impress their significance; and he feels ten times the pull from the ten-ounce weight succeeding that of one ounce. Later on he can understand that "4 ounces of tea weigh twice the 2-ounce weight."

When a child has been practised in some of the uses of numerals, he may learn to make choice of one object from among many—one marble taken from a basketful—simply because he is directed to take one. He should acquire methodical habits in procedure—say a method in examining any object he is directed to observe; you can point to the parts of it, then make him do the same. Take a post card and point to each corner, let him pass his finger along the top from corner to corner, then down the side, moving at the same rate—he will have felt the ratio though he may not be able to express it; he may say, “top longer.” He cannot express the length of the top and the sides by numbers till he has learned a standard of measurement; this requires experience and practice. (See Chapter VIII., p. 160.) In a lesson on the daisy flower there are many parts to look at, and the proportions of the green bracts, the white florets, and the little central yellow ones have to be described. All the training previously given will help in part to prepare the pupil for further teaching; so you progress stage by stage. I think that, in early years at least, we should produce many impressions on the brain such as I have shown we can control, and then couple them with words in teaching, and bring them into new relations under further instruction. Such training will assist the class work in reading, arithmetic, and geography.

The advancing pupil must often be taught by the

use of words, not thus directly connected with impressions which you can make on his brain. In moral training you may teach the precept, "Those who are good will be happy;" the boy will learn this as he writes it in his copybook and remember the words; only his subsequent impressions from experience will make him really accept its truth.

As another example, "All things tend to fall down." This statement may easily be explained when the child knows the meaning of "up," "down," and "falling." Many observations will agree in showing that things when unsupported do fall; the reason of this or the explanation of the fact will not be understood till much knowledge and experience have been acquired. Thus verbal impressions established early *may* gather strength with experience, or it may be that subsequent impressions will modify early teachings. It is something to the advantage of the child to have such early training as helps to connect or arrange his experiences, which may change in subsequent periods of life; in school days he may not think that "the good boys have the best time," with manhood's riper experience he may be convinced the other way.

Thus it comes about that knowledge is largely founded on observation and experience, but equally important is the share that is due to method as implanted by training and teaching.

It is very desirable that the teacher should form a

definite idea of the purpose of his labours, and, in the detail, form a concrete conception of his aims in an individual lesson, their connections and uses. Each lesson should afford some exercise in training the mental faculties for future use, as well as in employing those previously established as a means of implanting knowledge and experience.

CHAPTER II

THE BRAIN AND BODY IN INFANCY AND EARLY CHILDHOOD

MANY conditions leading to success or failure in the outcome of the later educational years depend upon the care bestowed during infancy and early childhood. I speak now of the first seven years of life as including the period of the nursery and home-training, rather than that of the school; it should, however, be distinctly understood that there is no such epochal period in Nature, but growth and development in some direction or other occur continuously, though not uniformly — the age period mentioned is convenient for description, but is in no way apart from the responsibilities of later life.

In infancy growth and development occur rapidly. During the first twelve months the head increases from a circumference of fifteen inches at birth, to nineteen inches; while the brain thus grows rapidly, there is a proportional evolution of faculty, mostly displayed in the movements and action of the child. Spontaneous and almost unceasing movements of the body characterise this period of great brain growth, while the body increases in weight from seven pounds to twenty pounds in the first year.

The infant at birth is not impressionable through the senses ; the most marked characteristics you will observe are the considerable strength of the muscles, and the amount of spontaneous bodily movement alternating with sleep. The strength of the muscles is shown in grasping your fingers ; this may be so firm as to enable you to raise the infant's body so that it is suspended as he clings to your hands. The limbs are at first mostly kept flexed or doubled up, any attempt to straighten them out, as at the elbow, is strongly resisted. The elbows are mostly kept bent, the thighs are folded up towards the body, and the knees bent also ; such postures alternate with stretching out of the limbs and movements of the toes. These postures return in states of childishness. (See Chapter V., p. 101.) The muscles of the back, however, are weak ; when the child is placed in a sitting position the spine bows backwards, and the head cannot be held erect. With increasing strength and development the limbs straighten out, the head is held erect and is moved about, while later on the back assumes the curves of the adult.

When movement is observed but does not appear to be controlled in any way through the senses, it may be called spontaneous, as being due only to the activity or vivacity of the brain ; it is originated in the child's brain, not excited from the outside. Spontaneous movement is seen at the earliest stages of infancy and continues as characteristic of brain action in early years ; this is



SHOWING SIMULTANEOUS MOVEMENT OF THE LITTLE FINGER
AND THE LITTLE TOE ON THE SAME SIDE

most marked in the small parts of the body, the fingers and toes; all may open out together, or one digit at a time.¹

The photograph shows the little finger and toe on the left side moving outwards as the child bent forward, looking at its father's foot. I shall have much to say about this spontaneity, and the brain conditions which it indicates.

In early days short intervals of wakefulness alternate with periods of sleep. In sleep the eyelids close and movement subsides except as to quiet breathing. If you gently raise the eyelids you will see the pupils minutely contracted, while the eyeballs may be moving separately, showing brain in activity.² The brain is not acting in sending out force to the muscles during sleep, circulation of the blood through the brain continues, as you may know by feeling the brain pulsate at the top of the head, quiet nutrition of the substance of the brain goes on; this is indicated by the infant's liveliness when he awakes refreshed.

The infant needs training even from the moment of birth. Habits of regularity in the times of feeding and sleeping and in bodily requirements may be established and lay a foundation for acquiring further character, while towards the end of the first year

¹ Tracings of the movements in "Anatomy of Movement," p. 4. Apparatus used in taking tracings described in "Physical Expression," p. 348.

² *British Medical Journal*, 1877, March 10th.

expression may be elicited and new lines of action may be formed by control through sight and sound: the child hears, sees, and feels. The great increase of brain growth calls for health culture; judicious feeding, light, cleanliness, good ventilation of the sleeping rooms, and out of door promenades — all are necessary to healthy growth and the formation of the faculties to be trained in the second and succeeding years.

The brain is an organ of the body, just as the heart is; the parts of the brain can act separately and perform different functions. One portion of the brain, or nerve centre, as it is called, may to a great extent act independently of other parts, while the various centres may act upon one another. It has been established by experiment that excitation of a particular brain area may cause contraction of a certain group of muscles, and thus produce a special movement, which is then an indication of the nerve centre acting. The brain is the principal organ producing the movements you see in the child.

The brain, like all living things, needs a supply of nourishment; while stimulation by sight and sound, viz., by what is seen and heard, is necessary for the healthy development of its functions.

You cannot see the child's brain, but you may carefully examine the head which contains it; take every opportunity of doing so, and notice the signs of activity in the body at the same time. The head at birth

measures 13.95 inches in circumference in the male, and 13.57 inches in the female. The **fontanelle** is a soft spot at the top of the head where you can feel the pulsations of the brain as it receives blood from the heart through the arteries; you will not be able to feel this fontanelle when the child has reached school age. The soft spot is a space between the bones of the forehead and those forming the sides of the brain case; it is closed in by a membrane and covered by the scalp; the surface here should be gently convex, not flat or sunken in, but continuing the general rotundity of the head. In an infant five or six months old you will feel pulsation, due to the amount of blood pumped into the brain, which swells up; this pulsation is also to be felt during sleep, showing that circulation in the brain continues during rest. When the infant is weak or ill the fontanelle sinks in from feebleness of the circulation in the brain, and at the same time spontaneity of movement subsides,—the child is too motionless. A good circulation in the brain is necessary to its activity. Besides the pulsation in the head due to the heart-beats, you may feel extra rising of the fontanelle with each act of breathing, while when the baby cries and gets red in the face, it swells up from the extra blood in the brain. Full movements of the chest, as well as the heart-beats, promote brain circulation. The fontanelle gradually closes up by the growth of the bones around it. It is largest at about

the seventh month and is not to be felt after the first year.

The head enlarges with brain growth, its circumference increasing to 19 inches at the end of twelve months. The brain at birth weighs 11.67 ounces in males and 10 ounces in females, and at from six to twelve months it weighs 27.40 ounces in males, 25.70 ounces in females.¹ In this rapid growth of the brain during the first year you see the way in which care for the health of the infant prepares the material structures upon which the benefits of training and education are to be implanted.

You should also look at the chest of the infant, and the movements of breathing. The chest is the cavity containing the lungs and the heart; it is formed by the ribs, which are attached to the spine behind and to the breast-bone (sternum) in front. The movements of breathing expand the chest and draw air into the lungs through the nose. In form the chest is slightly conical, smallest at the collar bones, with its largest circumference towards the middle of the body. There should be no flatness at the sides, nor any sinking in of the walls at any point as the breath is drawn in. The average girth of the chest is at birth 13.25 (males) and 12.65 (females) in inches; at five years, 21.40 inches; at seven years, 22.54 inches.²

¹ Tables of brain weights, see "Study of Children," p. 33.

² Further account, see *op. cit.*, Chapter II.

The lungs are the organs used in oxygenating the blood which circulates through them; their full expansion during early life is important, and like the brain they grow rapidly. The average weight of the lungs at birth is about 2.7 ounces, and at five to seven years about 9 ounces.

At about the ninth month teething begins; the process may give much trouble. When commencing practice I carried and used a gum-lancet, but experience showed me that most of the disorders attending this period are due to want of proper hygienic care, or bad feeding and the use of starchy foods, as well as other preventable causes.¹

Towards the end of the first year, the child will begin to imitate action in other persons, and to some extent becomes controllable, so that he may be trained to make some of the elementary sounds of speech and the movements used in walking; of course without allowing him to rest his weight on his feet.

Throughout childhood, habits need training; much may be done with the infant by regularity in the time for all things, and also in attention to health, in feeding, cleanliness, good ventilation, light, and daily promenades. The brain grows and the lungs grow as well as the body and the bones; the child may easily be spoilt in the first year from want of attention to the health of the body and the brain. Regularity in

¹ See "Study of Children," Chapter XII.

feeding has much to do with promoting proper digestion and establishing good habits; meals should be supplied at stated intervals; feeding the infant because he cries is a bad habit, easily encouraged. Uniform times for lying down and for airing out of doors, as well as for playing with his mother, help to form good habits in the child.

General playfulness and liveliness may be encouraged by talking to the child; he will play with toys, which should be few and selected, he will grasp them, transfer them from one hand to the other, or seize them with both hands, generally conveying all things to his mouth, though objects are soon dropped.

The infant develops into the young pupil; spontaneous brain action is abundant as expressed in much movement and in chattering; there is also some capacity for control through the senses, guidance of action under verbal direction, and, what is most important to early training, growth of the faculty of imitation.

These characters of the brain all demand cultivation and training, they interact on one another; and each has its place in the development of mental faculty and capacity for instruction. Retentiveness of impressions and the modes of their interaction or memory come later. It will now be found that the larger brained children have more aptitude, while those with little heads are more delicate. The very quiet

child may be good and give but little trouble; the stronger child has so much spontaneity that, till controllable and capable of guidance, his activities may interfere with good order and quietness; still the condition is hopeful.

In the years of school life the acquired power of self-control under guidance of impressions received in training, with memory for modes of procedure, directions, and principles previously taught, together with experience, gained and retained, give some intellectual ability, and begin to build up a basis of character which has been developed stage by stage, leading to capacity for duties in voluntary action or obedience, and to consideration of circumstances and the well-being of other persons.

We shall see examples of such activities when describing the general character of brain action, and in some brain moods and their reversion to a childish status in school children.

It is useful to separate what it is actually in our power to do with the infant and the child, from what we try to make his brain perform. We can, as shown, do much to encourage regular times of sleep; we cannot make the child rest. We can prevent him from injuring himself with unsafe objects, but cannot make him feed himself till he has acquired coördinated movements; we cannot make him walk, but can direct the movements of his limbs or prevent him

from walking. We can guide the pupil's hand in drawing or writing, or we may attempt to get his brain to do as we do in imitating our movements for physical exercises. At all stages the child should be childlike for his age; we do not wish him to be precocious.

The rapidly developing brain is here our chief concern, and will now be described in speaking of the general character of brain action.

The condition, status, and working capacity of the brain may be early observed and described by carefully noting the expression, movement, balance of the body and its parts, and the response in action elicited through the senses. These are the direct outcome and signs of action occurring in the parts of the nerve system (the nerve centres). It must be remembered that all mental action is *expressed* by movement and its results; whether it be spoken or written words, in action and in doing things, or by gestures and facial expression.¹

On these matters I have written recently in *School World*² and am indebted to the Editor for permission to quote from these articles.

The general characters of brain action may be described under ten headings; some only will be seen in early infancy, others evolve later, but all will need cultivation.

¹ Reference 2.

² *School World*—January to April, 1899. Macmillan & Co.

(1) **Spontaneity** in brain action for movement is characteristic of the infant, and is proportioned to the circulation as felt at the fontanelle. You see spontaneity in the child when you observe changeful expression on his face or smiling about the mouth spreading upwards around the eyes to the forehead, apparently of self-contained origin, not stimulated by what he sees or hears at the time. The eyes may turn to either side without being directed to you or any particular object, the movements may be up and down, as is often seen when thinking. The hands may show much spontaneity of finger movements, either as they hang by the sides, or when held out straight in front, on direction to do so. The feet may be shifted, the shoulders shrugged, and the head turned about without apparent cause other than spontaneous restlessness. There may be also spontaneous or uncontrolled utterances. All these movements represent healthy activity in the young brain, as long as the spontaneity is controllable; each act seen corresponds to the action of some brain centre. Spontaneity in movement lessens at seven or eight years of age as coördinated action gradually increases towards adolescence; while in mental action spontaneity remains till the brain degenerates.¹

Many thoughts in children's minds appear to arise

¹ Muscular movements in man, and their evolution in the infant. *Journal of Mental Science*, London, April, 1889.

spontaneously; "imagination," such as building up fairy stories, imaginary conversations, the doings of dolls and animals; thoughts in great part, at least, not controlled by what is heard or seen around. So in adult life; we think many thoughts other than those directly due to impressions of what we see and hear, thoughts arise in the mind (or in the brain) independently of the senses. This faculty of self-contained or spontaneous thinking lasts later in the life of the brain than the spontaneous vivacity of movement in the body. The adult is quieter in action than the child, but perhaps more self-originated thoughts arise in the mind, such as ideas of philosophy and those expressed in poetry.

Spontaneous action may be subnormal; it is lost in illness, and is often absent in the child with a deficient brain. In chorea, or St. Vitus's dance, it is excessive, also in some brain conditions of reversion of childishness, the fidgetiness of fatigue, and in irritable peevishness. Spontaneous movement may be uniformly repetitive, seen in "fixed habits," frowning, grinning, grimaces, and other subnormal action that will be described in the next chapter. In any case, each spontaneous movement as you see it, is due to, and indicates, discharge of nerve force from a nerve centre or portion of the brain.¹

(2) **Impressionability** of the brain is not marked in

¹ See Diagram of Brain, "Study of Children," p. 37.

the infant at birth, and there appears then to be no control through sight or hearing; it is, however, affected by warmth, and by cold as well as hunger, which cause crying. When three or four months old a marked impression may be produced by sight and sound in momentarily inhibiting movement; while later, such stimulation and inhibition is followed by controllable action. The child devoid of impressionability is ineducable, and those without sight, or deaf, are at a great disadvantage from absence of such paths for brain guidance. Much will be said hereafter as to different modes of producing impression on the brain, and the interaction of impressions in various ways. Impressionability may be indicated by any of the remaining general characters. (3-10.)

(3) **Inhibition of movement**¹ is seen in the infant of four or five months, when spontaneous action is momentarily arrested under the stimulus of some sight or sound; this may be followed by reappearance of movement as before, even if the stimulus continues, or it may be succeeded by some new line of action. The baby's fingers may simply keep still for a few seconds, or, the hand may move towards the object seen, while the fingers then grasp it; such prehensile act is called a coördinated (or regulated) movement.

¹ The study of cerebral inhibition, *Brain*, 1888, XLIII., Macmillan; and *Journal of Mental Science*, 1889, with tracing.

Action such as I have just described corresponds to the first mental attitude of attention. I hope the reader will look for himself at some infants, and notice this most interesting and important sign of dawning mental power.

You ask the pupil a question; he pauses a moment, and is still: if he answers in reply to your direction you know that some brain process of thinking occurred during the period of inhibition.

The pause period does not then mean absence of brain activity — as in sleep — but a new kind of action among the brain centres. The mere arrest of movement in young children is not necessarily “attention”; they may stand still without either thinking or moving. The faculty of inhibition of movement becomes rapidly manifested under good training.

(4) **Control through the senses.** — In the infant, control by sight and by sound are seen in any coördinate action following; such as grasping an object within view, or turning his head to the speaker; but at this stage, control is very temporary. When you are able to arrest spontaneous movements of fidgetiness you have clearly produced some impression on the child; but unless more than this is effected, it can hardly be said that you have controlled the brain. You wish to guide the child, and to train new and useful action in harmony with the surroundings, and to enable him to do as others do and to think as you

think. Such control of the brain may be established through sight and hearing. The effects of control are seen in action adapted by what the child hears, or what he sees in objects or the written page. Control, like all means of training, is usually in part an inhibition (or partial arrest) of spontaneity; when you get the controlled action wanted, there may still be some spontaneity accompanying it. If the pupil responds to you, perhaps it does not matter if he fidgets, and moves his hands while so doing; you guide and control spontaneous action without subduing it. Control of brain action, or, the discipline of class, is sometimes better effected through sight than by hearing; when the child is restless on being spoken to he may quietly obey your looks or gesture. Imitation is a form of control mainly effected by sight, especially at sight of action in the teacher or in classmates.

(5) **Control through muscle-sense.** — The literature of education contains many references to training the hand and the eye and the senses, as well as to the importance of exercising the muscles in drill, gymnastics, and games. I do not think that the control of the brain by impressions received from the muscles — or muscle sense — has been sufficiently considered as a means of brain training and a method of use in educating mental ability. (See Chapter VII., p. 145.)

Muscle sense in movement may produce impressions on the brain; as in a hand and finger action when

feeling the size and dimensions of an object, or in moving the hand to point out objects and parts of them. Any action in movement is caused by the contraction of muscles, which not only produce what we see, but also send stimulus up to the brain and produce an impression on it. Movements of the eyes in counting, or in following the outline of a map, or the figure drawn on the blackboard, thus produce impressions by muscle sense.

Muscle sense in tension is another means of controlling the brain and producing impressions. The tension or strain in a muscle when contracting and overcoming a resistance is felt by the brain; this occurs when a weight is held in the hand, the muscle sense in tension being affected in proportion to the weight. Exercise in thus appreciating weights by feeling them is most useful in training the pupil to understand "addition" and "proportion," which he may thus be made to feel.

It is not easy to test muscle sense till some means of expression has been acquired by the child. This faculty is indicated in the pupil who counts objects or marks on the blackboard—either at sight, by moving his eyes (by use of the muscles of the eye-balls) or his fingers in pointing; or again as he counts on his own fingers, bending them one after another; also in measuring distance or dimensions by sight or feeling. Both the size and the weight of objects are thus estimated

by muscle sense, while weight can be discriminated from size after practice.

(6) **Compound brain action**, or compound cerebration, is a most interesting process to watch in the young child; as this faculty develops, it begins to afford the basis of brain action leading to mental power. An impression made on the brain through the senses may stimulate two or three nerve centres, which, after sending out nerve currents, may become quiescent and rest again. The centres thus secondarily stimulated may act in similar manner, becoming quiet in their turn; thus there is not an ever increasing amount of brain action; but the first group of nerve centres stimulates the second, and the second acts on the third, —so that finally an adapted action in movement or expression results.

This is very analogous to a trained set of impressions or thoughts, as a process established in the brain, where the question or direction leads to thoughts arising in order, during a pause; the final result being expressed in response. The pupil, who has previously been taught, is told to examine a seedling pea that has been sprouted in damp moss; he holds it and removes the case with a needle, divides its parts, the two cotyledons, the stem and the root, finally placing each part in order on a card. Here one act follows another in the order taught; centre after centre in his brain acts and then rests—if every-

thing is attempted at once the object is smashed. Thus a series of acts is performed one after another in order, involving the fingers and eyes of the child; the whole action followed a very slight stimulus; viz., the verbal direction of the teacher. So a hand exercise learnt may be repeated, act after act, without confusion or guidance.

In such examples of compound cerebration there is interaction of parts of the brain on one another, whether under continued guidance, or following a simpler direction and the results of former training.¹ Interaction of one brain centre upon another may be inferred when the expression seen differs greatly from the sensory impression which it follows, but at the same time is clearly adapted by it. When the child simply imitates your movements, each separate act is guided by sight, there is no necessary interaction among the centres; when the exercise is repeated from memory, the centres react on one another in the repeated order. This process of compound action among brain centres is not observed in the young infant, it is only developed gradually, and built up in the child as the faculty of retentiveness grows and is cultivated. Habits and modes of procedure in action are established by training, and thoughts are learnt in order as taught; this is physiologically represented in the brain by established modes of order in action.

¹ References 2 and 6.

(7) **Retentiveness** in the brain is shown by movements when a physical exercise is readily repeated in each act of a series, and in orderly habits carried out punctually; also in a series of words or thoughts remembered. It is probable that retention of the arrangements in the brain centres, both for series of movements and thoughts, depends upon similar physiological conditions; viz., the establishment of nerve paths between the centres, by which nerve currents pass from one to the other in order, calling them into successive activity. Retention of the terms of direction used in controlling a child, coupled with the action intended, is important; the words of command should be uniformly used, and heard distinctly, to be followed by the action directed. In this way terms of direction become useful means of self-contained control, in cultivating voluntary power later on. Retentiveness much depends upon the distinct and definite or accurate reception of the impression to be retained. If the child is to remember where to find his books, he should look at them and see them in their place, when he has put them there; if he is to remember the order of the numerals he must hear each word distinctly; and, better, *feel* movements for each number named. Retentiveness is not seen in the earliest infant stages; it may be cultivated in the child by regularity in habits and in the order of doing things. Retentiveness may lead to persistence in doing something, or continuing to do it too long. When a class of

children are told to hold out hands, some persist in doing so after the rest have dropped theirs ; thus the action in the brain is retained.

Memory is a form of brain retentiveness both for words and action ; thus the teacher draws a map on the blackboard and points out the site of the principal towns, while the pupils reproduce the map at home.

(8) **Coördinated action.** — As to movement, this implies regulation of each act in the series of movements brought about at first by control through the senses. You throw a ball at a boy ; he catches it and throws it back ; the sight of you and then of the ball quickly advancing so determines the order of his brain centres in producing his movements that this well coördinated action follows. Practice makes him more apt in catching the ball, the nerve mechanism for executing the required action works more and more accurately ; this rapid advance in coördinated ability is a good indication for future mental capacity.

In training this faculty of coördination under guidance, the nerve centres exercised thereby become gradually connected by nerve paths, so that the action is easily and accurately repeated ; or, as we say here, compound cerebration is built up, and the action called for may follow a simple direction. Impressions on the brain and thoughts may be similarly coördinated ; when you point out the parts of an object two or three times over, the child looking at each in succession will

at last remember all that has been shown him. Co-ordinated action, when often repeated, tends to be retained, but at first it will be accompanied in expression by some spontaneous movements in a young child; still, if effectual control is established, that is all that we need look for.

In the infant, a little after inhibition is first observed — that is, about the fifth month — coördinated action is seen, when at sight of an object the hand is moved towards it and the fingers, first opening, then grasp it. It is here that spontaneity, controlled and regulated, leads on to the more precise coördinated action. We thus see that inhibition, succeeded by some coördination of movement becoming gradually more exact, leads on to the retention of order in action among the nerve centres, and the dawning signs of compound cerebation, indicating faculty for intelligence.¹

(9) **Spreading area of movement.** — Visible action may spread without control, or as the result of stimulus by sight, sound, or feeling. A smile may spread in the face, following some spontaneous thought; this may pass on to widening of the mouth, half closure of the eyes, turning of the head, and movements of the hands and fingers till, in a burst of laughter, the whole body seems to take part. When the child is told to make a calculation in mental arithmetic, the tongue may be protruded, then the eyebrows contracted, the head

¹ Reference 5.

and eyes turned upwards, while movements are also seen about the mouth and lips. When a child's finger is hurt, the angles of the mouth become depressed and its line arched downwards, the brows knit, and the forehead crumpled, with the eyelids closed; while the fingers are much moved and the respirations disturbed, the child growing red in the face; finally his closed fists are pressed to his eyes and he cries aloud. So, in a storm of passion, the boy turns his head and eyes towards a schoolfellow, the canine tooth on that side is uncovered, the eyelids are retracted, a conflict of muscular action about the mouth may cause the lips to twitch. Breathing quickens, the face, at first pale, now flushes, the chest is fixed, the fists clenched, and he hits out. In other instances, in place of rapidly spreading area of movement seen in expression of emotion, a uniform trick or habit is observed accompanying any mental effort; the tongue may be protruded when the child is spoken to; the head moved to one side, some uniform grimace may be seen, or the feet may be shifted. Stammering is a spreading muscular spasm attendant on pronouncing certain sounds.¹

In all cases the spreading area of movement observed indicates a nerve centre discharging its nerve currents to more than one brain centre, and then *not* resting; so that the nerve currents become reinforced or strengthened as they pass from one nerve cell to an-

¹ "Study of Children," pp. 95, 115, 117.

other over a widening area of the brain, finally proceeding to the muscles which produce the movements seen as expressing the brain action occurring in emotion. This represents a superfluity of brain action in movement.

(10) **Response of the brain** to some stimulus is seen in the movement following an impression through the senses. An object comes within view of the infant; the act of seizing it which follows shows early response in his brain, producing the movement. It has already been said there may be a pause between the sensory stimulus and its expression; you may observe an interval between the eyes turning to the object, and its being grasped. When a question is asked, there is an interval before the reply, if thinking takes place; the brain-processes corresponding to thoughts occupy time. The response, either in movement or any mode of expression, may be delayed.

Thus modes of brain action indicated by movements which you may observe, have been described as representing different kinds of action among the brain centres, which will be found to correspond with various mental states, affording faculties, all of which need cultivation and training. It was convenient thus to commence with some description of the brain in infancy and childhood, by speaking of the kinds or classes of action, instead of giving detailed signs; because, as each class is expressed in many ways, they

must be more or less familiar to you from associating with children, and some points referable to each class may have previously attracted your attention, so that you can recognise their place in this classification. A case is here given in illustration :—

A BRIGHT, HEALTHY BOY TEN YEARS OLD

1. **Spontaneity.**— Playful. Expression bright, often changing ; eyes much moved. No frowning. Finger movements. Talkative.
2. **Impressionability.**— Looks at what is shown him, quiet when spoken to, and looks at teacher. Generally obedient.
3. **Inhibition.**— Is quiet when called upon in class ; after a short pause replies to question put, then looks at others in class. He stops to think.
4. **Control.**— When looking about, is better controlled by a gesture than a word. Prompt in physical exercises. Answers something to each question.
5. **Muscle sense.**— Expresses fairly the weight of coins felt ; can compare lengths at sight well, and count objects. Good at games.
6. **Compound cerebation.**— Free hand exercises performed under guidance or without it. His thoughts are becoming orderly and systematic.
7. **Retentiveness.**— Each of his movements and their order exact in physical exercises. Good memory for vocabulary and poetry.
8. **Coördination.**— His movements are well regulated and orderly ; so are his thoughts for subjects he has been taught, as rules of arithmetic.

9. **Spreading action.**— Seen in his playfulness after school ; in fidgeting during lesson. He asks questions not appropriate to the lesson sometimes.
10. **Response delayed.**— Interval between question and answer becomes longer when fatigued ; also when he is slow in thinking out the reply.

CHAPTER III

THE CHILD AT SCHOOL

WHEN the pupil is received into the school his proper class place may be wisely determined by some observation of the child, as well as a brief mental examination. It is in the observation of the **general characters of brain action**, as described in the last chapter, that a rapid judgment may best be formed as a first aid in school classification. To determine the individual status of the child, including his abilities and special needs in training, detailed points must be described, such as will afford indications of the management wanted in class training; it will be seen in the next chapter that the class teacher may obtain much help in understanding his pupil from a detailed description: this serves to guide his own further observations and experience. When the children in a class are known in this way, observations will soon accumulate, and experience will be gained for the establishment of a Mental Hygiene, and also in employing the principles of physiological mental science as an aid to educational methods. In subsequently studying the records thus obtained, and the various faculties making

up the sum of the brain capacity of children, we shall see the needs of infancy preparing for childhood, and of the child developing to adolescence and manhood or womanhood.

The results of my observations of one hundred thousand children in schools have been analysed and classed in various ways;¹ they are always grouped as boys and girls separately, so that differences and resemblances among them may become apparent; they have also, as far as possible, been arranged in age-groups, to show the progress that occurs during school life. Thus a basis of facts has been provided for the scientific study of the mental and physical conditions of childhood.²

In observing the child, you must know what to look at and what to look for; after a time you will learn, from what you see, to make correct inferences as to the conditions and the changes occurring in the brain of the child before you. Much help in this work will be derived from methodical procedure and description of the facts seen. When making your observations, do not talk to the child or touch him, but let him stand quietly as you look at him point by point. To do this conveniently it is necessary to prevent the child from looking at you, while examining his head and face: if you hold

¹ "Report on the Scientific Study of the Mental and Physical Conditions of Childhood." The Macmillan Company.

² For statistical analysis see References 15, 41.

up a small object in your hand, just telling him to look at it, this fixes his eyes, and he does not see you as you look at him.

Now proceed to examine his face part by part. The face may be described in three zones,—the forehead above the eyebrows, the eyelids, and the parts around them,—then the lower part of the face, including the cheek-bones and the nostrils, with the region around the mouth,—each area presents points for observation.

The child's forehead should be generally smooth and placid, corresponding to quiet brain action, and a mental status neither wholly uncontrolled nor too much stimulated. There are two pairs of muscles in the forehead, the one placed vertically under the skin so that by their contraction they make horizontal creases, the other is placed horizontally between the eyebrows, drawing them together in action.¹

The **frontal muscles** acting, cause frowning, with horizontal furrows of the forehead; this may accompany a discontented mental state or an unoccupied attitude. The sign is often repeated as a habit. It is much more frequently seen in boys than in girls, and is most common in those with any degree of brain defect.

The **corrugator muscles** knit the eyebrows, drawing them together, thus producing vertical furrows. This may be seen under mental stress, or in a class engaged in mental arithmetic. It may also occur together with

¹ Drawing of muscles of face. See "Study of Children," p. 21.

horizontal frowning, causing a bad scowling expression in the face.

The *orbiculares oculi* form a pair of circular muscles surrounding the eyelids and closing them ; they also give good tone to the lower lids in a lively child, and shapeliness, while in smiling they make folds in the skin. In fatigue, and the debility accompanying headaches, these muscles lose their tone, the face looks full and baggy about the eyes, the muscle is lax, and the shapeliness of the lower lid is lost.¹

The mouth.— In the lower part of the face the mouth and the parts around it are the principal seat of expression. The mouth, when quiet, should be closed, breath being drawn in through the nose ; but some children cannot breathe without opening the mouth. This is a matter calling for medical treatment. The line of the mouth is naturally nearly straight, but the angles may be drawn upwards or downwards.

Grinning and over-smiling consists in an upward and outward movement of the corners of the mouth, widening the opening and making creases in the face running from the nostrils to the angles of the mouth. Similar action occurs in healthy laughter, which spreads to the eyelids. In conditions of pain the angles of the mouth are drawn down ; so also at the commencement of crying and other spreading movements. In the state of passion the canine tooth on one side may be uncovered.

¹ Reference 28.

Expression in the face as a whole is one of the best signs of the mental status of the child. A bright, lively, changeful expression indicates spontaneity, and is a hopeful sign of mental aptitude, while a spreading smile about the mouth to the eyelids shows brain activity, and may indicate mental action which the pupil cannot express in words.

The absence of facial expression is a marked sign of a dull brain without spontaneous activity; this may be seen in fatigue, or day by day in an exhausted child.¹ The face may bear a good general expression, and in addition show any of the signs described; conversely, these signs may be seen in a face devoid of general expression.²

In looking at the face you see the eyes; *i.e.* the eye-balls—the muscles that move them have special nerves coming direct from the brain, apart from the nerves to the muscles of the face; eye-movements should therefore be observed apart from action in the face, and are very interesting as signs of brain action.

Eye-movements may show much spontaneity, turning every way, though most frequently in a horizontal direction, leading to but vague impressions at sight, though many objects may be seen. Some children look about, and at the words in the book, by moving the head only, not turning the eyes at all. Try how the child follows your finger as you move it, whether by

¹ See "Study of Children," Case 21.

² Reference 4.

moving his eyes or his head; test also his power to fix the eyes well on what he is told to look at. Irregular eye movements interfere with learning geometry. (See Chapter IX., p. 180.)

The hand in its attitudes, the movements of its parts, and its ability to perform many actions is almost as good an index of the brain as the face.¹ In order that you may observe the effects of the action of the brain on the hand it must be free to move within your view; neither hidden behind the child's back, nor resting on the table, but held out and balanced as the muscles move it under the control of the brain.

Let the child stand; tell him to hold out his hands in front with the palms down, and show him the action momentarily. In a well-trained active child response follows; the arms are raised to the level of the shoulders and horizontal, straight at the elbow, the arms being parallel to one another, and the distance of the chest apart. The hands and fingers should balance straight at the wrists and knuckles; all parts with the fingers and the thumb in the same plane, so that a card placed on the back of the hand is touched by each digit. This shows a normal or good balance among the brain centres, well coördinated by training. As the balance depends upon a uniform action of certain brain centres, you should not make the child hold out his hand thus for more than half a minute at most;

¹ References 3, 9, 16.

the attitude is tiring, like any persistent uniform mental effort.

The **weak hand balance** shows a marked difference from the straight attitude; this may occur in different degrees. The wrist droops, the bones of the palm of the hand are somewhat folded together, while the thumb drops and all the fingers are slightly bent. All this shows less action in the muscles, and less force produced in the brain centres which make them act. If you get the child to look at your straight balanced hand and imitate it, you control his brain attitude to be more like yours; as he sees your hand, his brain centres begin to act and balance as yours do, and the hand straightens up. Thus you influence the brain of the child through his eyes by sight of your hand, controlling his brain centres: all this you may observe as the hand straightens in imitation of your action.

If you gently raise the arm of a child in sleep, the hand falls into the weak or drooping attitude, which is characteristic of a brain state not sending out force. The weak hand balance is seen in those who are listless, careless, or tired; it is common to observe the posture more marked on the left side; and also to find that a child, when directed to hold out his hand, keeps the left at a lower level than the right, whereas both should be at the same level.

The **nervous hand balance** is a modification of the posture last described, and like it may be seen in vary-

ing degree. The wrist droops, the palm is folded or contracted together and looks narrow, arched on the top and hollow on the under surface; the thumb is bent back and each finger is bent back at the knuckle-joint. This attitude, like the weak hand, is often more marked on the left side. You will not see this in the restful conditions of sleep; it indicates some degree of weakness, together with some overaction or excitability of the brain centres.

The nervous hand balance is common among nervous children and adults; those who sleep badly, suffer from headaches, often with capricious or voracious appetites and disturbance of digestion, and vague debility without disease.¹ This sign does not indicate a state of brain inactivity like the "weak hand"; rather weakness with excitability, such as characterises the condition of St. Vitus's dance; it is not usually accompanied by mental dulness of brain.

The fingers can move separately, each act being due to the activity in a brain centre; thus the parts of the hand move separately, indicating brain action in writing, or express thoughts in drawing, or produce music on the instrument; in each case the centres for finger movements are guided by sight. Finger movements indicate the brain state.

Finger twitches. — When the hand is held out for you to look at, if the fingers touch one another they

¹ Reference 32.

give mutual support, and you will probably see no movement; therefore take care to see the fingers separated or spread out, when they ought to be straight and steady.

You may, however, see twitches of one or more fingers; these may be either up and down (flexor-extensor) or lateral,—the latter are more common in nervous, mental conditions. Finger twitches often accompany the “nervous hand” posture in weak conditions.

The spine is a column composed of many small bones, and is capable of being bent in various directions; postures of the spine should be noted.¹ If a child when at his desk constantly bends to one side, making one shoulder higher than the other, some lateral curvature of the spine is likely to follow—stooping and bending the back in reading or writing may be due to short sight, requiring the use of spectacles. As the child stands, the shoulders should be at an equal height, with the head erect; when the hands are held out quietly in front, there is no alteration in the outline and curves of the back resulting from the action if the child is strong.

Lordosis.—When the hands are held out, the action may result in arching forward of the lower part of the spine at the loins; while the upper part between the shoulders is thrown back. This is best seen in a profile

¹ See Drawing, “Study of Children,” p. 23.

view of the child, and is due to weakness of the muscles of the back, and commonly accompanies a state of debility. An energetic child will often shoot forward his hands, especially if the fists are closed, arching the back at the same time; the energy of such action shows the absence of weakness, while the exercise can be more quietly repeated without movement of the spine.

Other nerve signs I have described elsewhere,¹ only repeating here those that are most obvious and easily observed, specially selecting such as should attract your attention as being points which may guide class training, and adapt it to promote mental abilities and remove the brain disabilities indicated by these sub-normal nerve signs. If the child does not stand straight and move the eyes well, these form matters for attention in the exercises used. My chief purpose is that your method in training should be guided by your own observations of the pupils in the class. (See Chapter VII., examples.)

A few remarks may be useful as to the relations between the **general characters of brain action** and the individual nerve signs, which have not always the same significance, just as the meaning of words varies according to the connections in which they are employed. Thus — “**frontals overacting**” is usually a sign of spontaneous action in the nerve centre producing it. (1) In as far as you cannot control the movement,

¹ See Author's “Study of Children.”

this sign also shows want of impressionability, (2) and incapacity for quiet coördinated action. (8) It may appear as part of a spreading area of action in the face, (9) in stammering or in full laughter.

“**Corrugation**” most often belongs to the class of spreading action (9), as indicating a (useless) overflow of nerve energy accompanying some mental act; but it may also occur apparently as a spontaneous action (1).

“**Smiling**,” after a pause occupied in thinking, is sometimes the first indication that a reply has been arranged in the brain. Grinning, as a uniform repeated spontaneous movement, in the absence of controllability or the signs of compound cerebration, shows marked dulness of brain or deficiency.¹

“**Eye-movements**” may show spontaneity, and yet be controllable through sight or by the word of direction; they may produce impressions on the brain by muscle sense, as those corresponding to number, dimension, or size. (See Chapters VII., p. 145; IX., pp. 180, 185.)

Nerve signs are often associated with one another in the same child and form points for describing his brain status. Their individual value has to some extent been determined by working out their co-relation with mental dulness and other conditions as recorded in the notes of the cases. Thus:²—

¹ References 17, 20, 21, 22.

² See “Report on Scientific Study on Children,” The Macmillan Company, 1895, pp. 72 and 104.

Of 715 boys 504 girls with the "weak hand balance," 40 per cent boys, 35.3 per cent girls, were reported as dull or backward.

Of 550 boys 516 girls with the "nervous hand balance" 34.3 per cent boys, 32.9 per cent girls, were reported as dull or backward.

Of 1322 boys 294 girls, with "frontals overacting," 41.4 per cent boys, and 46.2 per cent girls, were reported as dull or backward.

It is thus seen that these sub-normal nerve signs are associated with brain conditions causing mental dullness, and that, consequently, training ought to be directed to prevent or remove such in detail. In this the class teacher will be guided by observation. (See mistakes in arithmetic. Chapter IX., p. 185.)

Further: these nerve signs, and the signs of the **general characters of brain action** in a child afford a basis for the study of physiological psychology; we want to know the process going on in his brain which corresponds to mental acts and expression, so that observation may guide us in tracing out what occurs when using methods of teaching; and in seeing, where difficulties arise, how training may be employed to remove them and promote orderly action in thinking and learning. (See Chapter VII.)

The constitution or make of the child, as well as his healthiness, depend largely upon his development.

Physiognomy, as well as anthropometry, or measurement of the parts of the body and their comparison, tell us much as to the development of the child, whether normal or otherwise. When the body is well developed there is a great probability of a healthy active brain accompanying; the two conditions are correlated, but their coexistence in an individual child is not to be assumed without observation of the signs of brain action, normal in kind, according to the age of the child. Physiognomy depends upon the proportions which produce the form of the individual features, and their relations in growth; a well-made body with well-proportioned head and features, generally has a well-balanced nerve system and is well nourished and healthy.¹

The head of the infant has been sufficiently described in Chapter II. At seven years of age the circumference should have grown to 20 or 21 inches, while the average weight of brain has reached to over 40 ounces; the weight of the adult brain being 50 ounces in males and 45 ounces in females.

A head of 19 inches in circumference at seven years is small; the volume or content of the head is a matter of great importance. Most forms of ill-shapen heads, as well as other defects in development, are more frequent in boys, but the small head is an exception as being far more common in girls,

¹ Reference 42.

who often tend to be delicate, though of average mental ability. The forehead should neither bulge forward nor recede from the vertical plane, the bones should be smooth without any ridging or lumpiness; among subnormal conditions, the forehead may be contracted and shallow; each defect has a significance. The head is the principal indication of a well-developed child; other physiognomical signs vary in value as indications of the probable brain status. Further points for observation I quote from my article in *School World*.¹

The features should be well moulded individually and proportioned to one another; in place of this they may be coarse, or, while no one feature is ill-formed in its parts, they may be disproportioned, the nose small, but the face large and rounded. The parts of each feature and their proportions should be observed; in particular the absence of any normal part of a feature should be noted—as is so common in the ears, where the rim is often deficient.²

Looking at the face, observe each feature separately. Compare the two sides, looking for symmetry of development. Carry your eyes to each ear in turn; they should be of similar size and form, with the margin slightly curved over, and the pleat of the ear (antihelix) projecting in front of the rim well developed, causing the ear to lie flat against the head in its proper posi-

¹ *School World*, March, 1899.

² Reference 23.

tion. The pleat of the ear may be absent, or the rim may be imperfectly developed, the whole ear being large and outstanding; concave in form and red or bluish. This is common among boys, much less frequent in girls; the defect is not associated with dull hearing.

The **nose** is seldom quite symmetrical; its bony bridge has no forward growth in infancy, but develops out later, say by seven years; it may remain broad, flat, and thick in growth, with tipping of the end of the nose upwards, the nostrils perhaps being small. Such children are apt to be "mouth breathers," the nasal passages and the mouth may both be small; this may lead to acquired causes of deafness.

The **mouth** in quiescence should be of good size — it is seldom too large; the common reference to a large mouth is due to the frequency of grinning, which widens the mouth in action, accompanying brain deficiency. A small mouth, though the feature may be admired as artistic, is a subnormal condition frequently associated with a narrow palate and with small eye-openings.

The eye-openings (palpebral fissures). — The openings between the lids — where the eyeballs are seen — should be sufficiently large in proportion to the other features, and the axis drawn from the inner to the outer angle should be horizontal. These openings may be narrow or too small, the transverse axis

may slope downwards, as in Polynesians and other tribes. Small eye-openings, accompanied by a small mouth, produce a blank, featureless physiognomy.

The palate.—If you look at the roof of the mouth you see the bony palate; its size and form are important indications of the developmental constitution of the individual, second in importance only to the head or cranium. There should be sufficient width or space between the teeth, rounded in front, while in the vertical direction (vertical plane) it is a bowed rather than a Gothic arch. The palate may be narrow, or contracted laterally, and more or less sharply pointed anteriorly, it may also be highly arched or vaulted in the vertical plane; each of these deviations in form is subnormal. If the palate is narrow, the teeth are usually crowded in front: all forms of defect in the form of the palate (except when fissured or cleft) are consistent with fair speech.

The growth of the child may be measured by his height, and compared with the normal for the age as shown in Standard Tables,¹ the weight of the body may usefully be added to the description. There appears to be a larger proportion of small girls than boys; the same rule applies to children under weight.

Having described points for your observation of the child at school age, it remains that I should indicate their bearing on mental and physical hygiene and on

¹See "Study of Children," p. 31.

your care and training. We have seen that **spontaneity** of brain action is the great characteristic of early days; this affords a basis for cultivating coördinated action under control, thus preparing the young brain for the work of childhood and the responsibilities of adolescence. The child in school becomes an object for observation to the student; while the teacher has the labour of training the general characters of brain action, adapting his methods of instruction to the pupil's mental capacities as they are evolved and cultivated.

Healthiness is necessary to spontaneity and mental brightness; it must be remembered throughout the school life that the brain needs to be nourished during its rapid growth and development, as well as later, when evolving further faculties and retaining many impressions.

Impressionability is increased by practice; things seen and sounds heard, which do not at first attract the attention and produce any apparent impression, may do so later on if persistently followed up. Dr. G. Shuttleworth¹ says: "A very impassive, imbecile child is so inert as not to put up its hands to protect its face against a bean-bag thrown at it by the teacher; gradually, however, the instinct of self-preservation asserts itself so far as to ward off the missile."

¹ "Mentally-Deficient Children," G. E. Shuttleworth. Lewis and Co., London.

Control through the senses is cultivated by practice; we can make impressions on the child's brain by causing him to see, to hear, and to feel. In training, stage by stage, we should plan our methods so that the early impressions made in the brain are such as will be useful at more advanced stages; this is true economy, and will make later teaching easier. It seems to me that, as far as possible, early impressions should be produced without the use of words, in an arranged order on a fixed plan, which can be repeated afterwards; these impressions can be revived and connected with names, when terms have been taught. If you wish to impress the colours on a child, show them one at a time with a slight interval between each; colour with no particular form is best—torn pieces of paper of the true colour, not painted toys. The pupil can afterwards learn to pronounce the names, "red," "blue," "yellow," as he looks at your face; then couple sight with the term; thus you make impressions by sight, then give words, and proceed stage by stage without a chance for confusion to occur. As a means towards control through the senses, the sense organs themselves need healthy exercise; town children do not get the same opportunities as those in the country for seeing distant objects, still they may be made to look up a straight street, or at the clouds, the setting sun, the moon, and the stars. There is a muscular apparatus in the eyeball which is exercised by vision at

varying distances; it contracts on looking at near objects and relaxes for distance, when the pupil of the eye expands also. Soldiers are thus trained to estimate distance at sight. Hearing may be trained in listening for distant sounds and the notes of the birds, while musical sounds and singing may help.

Impressions by muscle sense call for careful consideration. While much attention is given in early school days to training through the eye and the ear, it seems that too little care is bestowed on the value of training the brain by impressions produced on it through the muscles. This is totally different from exercising the muscles for the purpose of making them grow big and strong. When, in the drilling class, the child performs exercises with the fists closed, raising the arms over his head, or again, touches his knees, and then quietly straightens his back, the muscles themselves are brought strongly into action, and their strength is increased by such exercises. Drilling the muscles promotes their healthy growth, and to some extent improves the brain; it makes the bones grow, strengthens the joints, expands the chest, leads to expansion of the lungs and fuller breathing power, while strengthening the heart. Physical exercises give a good carriage and gait to the children, with some grace in movement; the muscular activity promotes growth of body in girls and boys, if the body is healthy.

Apart from the physical exercises adapted to cause growth in the body, the muscles may be used like the sense organs, as the means of producing impressions on the brain which will be of much use subsequently in training mental processes. The strain on a muscle is felt; place a weight in the hand, it makes a pull upon the muscles of the arm which is felt by the child. Place in his hand in succession metal weights of one ounce, two, four, eight ounces, the strain produced by each is proportionate to the weights. If 1 + 1 + 1 + 1 ounces are added to his hand, the addition of weight is felt. When it is the degree of muscle strain you want to use as a means of brain impression, see that the hand is held out free from the desk; it may be moved up and down with the fingers open, so that the size shall not be felt at the same time by the fingers and so make a second kind of impression. In this way the child may be made to feel the addition of weights or impressions which are proportional, before he has any words to use for addition or comparison. If you cause the child to make one movement of his hand and drop it, then ten similar movements regularly in succession, the impression upon the brain centres is greater in the latter case. Control through the senses should begin in the first year; in commencing, such control should be very temporary, as the attention is momentarily attracted; still, in the "play" of infancy some impressions are produced on

the brain, even if not retained. So it is in later evolution, impressions are produced, but may be transient; training is effected, but its outcome and benefits are not seen till a later stage.

Thus evolution comes about stage by stage; spontaneity at birth is soon accompanied by some impressionability, and a little later by control in temporary inhibition of movement, which soon leads on to action coöordinated through the senses, and this, when retained, brings the child a long way towards mental development.

Compound brain action implies the establishment of nerve paths between various brain centres. The physiological law appears to be that impressions produced in the brain at one and the same time, or in immediate succession—so that the two or more brain centres are coactive—tend to become connected by nerve paths, or are so far united as to be easily brought into reactivity in the same order as that in which they were produced. Modes of movement imitated in repeated exercises become more exact with practice, till they can be reproduced alone without guidance when once started; the nerve centres producing the movement have grown together. Words heard in a certain order—the letters of the alphabet, the numerals, or a verse of poetry, are retained as impressions on the brain and reproduced in order. Established compound brain action gives retentiveness, not only for a word

or an act; impressions retained among the nerve centres establish arrangements for series of movements and sequences of acts. Thus your training, and all that the child sees and hears, produce impressions in his brain which may come into action later on; habits are formed, trains of thought are implanted, and the child growing up begins to do and think as he has been trained and taught.

Coördinated action controlled in each movement or act is brought about through the senses; if uniformly repeated, this tends to establish a mode of action in the brain. Hence the importance of exactness in all you do in training the child, and the advisability of forming an idea of what you want to accomplish. Control of the brain centres inhibits their spontaneous action, causing them to act in certain new relations of time or degree—further; as I have said, there is evidence that nerve paths from centre to centre are formed the while. Producing coördinated action is a delicate process in brain culture; it should not be long continued at one time without allowing intervals for the return of some healthy spontaneity. (See further, Chapter V., p. 105.)

Spreading area of brain action seen in facial expression often accompanies mental action. Knitting the eyebrows may indicate mental stress or confusion; frowning (frontals overacting) as a uniformly repeated action when the child is spoken to, or occurring spon-

taneously, may indicate weariness, or either too much or too little stimulation of the brain. In fatigue and weariness, spreading movement is seen in fidgetiness, and a tendency to chatter; which may sometimes be met by a change of occupation.¹ Laughter has been described as a spreading area of movement; I think it may be allowed and employed usefully to remove brain impressions when a new line of action is wanted. After making an absurd mistake, due to mental confusion, if the pupil will laugh with you—not you at him—his face may grow cheerful as he tries again. Spreading movement in the young child is seen in his spontaneity and in the signs of happiness.²

Response and expression it is always important to observe. Response may be similar to the stimulus, as in imitation of your movements, or repetition of your words; action similar to yours, as expressed, naturally tends to occur in the brain of the pupil, if it does not always take place; that is to say, the same centres in the child's brain are stimulated as those active in your head in giving the direction. Higher forms of response in mental action are due to interaction of the primary impression, or direction, with many previous brain impressions implanted by teaching. You ask where he has been during the holi-

¹ See Muscular Movements in Man, *Journal of Mental Science*, 1889, April, Paragraph 38.

² Physical expression. See Illustrations 49-45.

days? Impressions of what he has seen revive to activity and are expressed in his response. As regards verbal response this must necessarily be limited by the vocabulary acquired, and the correct association of impressions with the terms of expression. Response in facial expression is most likely to be true, as when the child looks happy and says he knows his lesson, though he cannot repeat it. I once had to see a boy who went to school, where he looked distressed, and gave a message that he was to return home as his baby brother was dead. This was totally without foundation, he had no brother. This child often had illusions and saw what existed only in his brain; he soon after became subject to epileptic fits.

Response may be delayed with too long an interval between the question and the answer; sometimes, however, a question is answered several minutes after the question; showing that processes of thought have occurred in the interval.

Training the general characters of brain action is a first step in mental hygiene towards developing the faculties in the child's brain which are to be acted on by your teaching: at the same time evolution of healthy action is encouraged and employed which renders the brain less liable to nerve storms in the form of emotion, nervousness, headaches, and other distressing conditions.¹ There is a useless waste of brain power

¹ Reference 27.

in the child when endeavours are made to correct and arrange thoughts that have only been partially formed in the brain ; still, this seems often to be attempted too early by the employment of verbal instruction, and neglecting to train by impressions through the senses and by muscle sense. All fundamental impressions, such as colours, numbers, proportion, size, and notions of time and weight, need to be produced by impressions on the brain before comparisons can properly be understood or expressed.

Spontaneity should be cultivated, as well as impressionability and the control of brain action. Control and attempts to produce coördinated action must be arranged on a fixed plan, that the present training may prepare for advancement, and provide those impressions in the brain which will be employed in teaching later on. The school superintendent who forms a concrete idea of the instruction the child should receive in succeeding stages of education will analyse the advancing stages, and take care to arrange that the preliminary training needed is afforded at the right time. Thus training should be adapted to afford future capacity for learning, while teaching may be carefully arranged to exercise and employ the capacities already acquired.

CHAPTER IV

OBSERVATION, DESCRIPTION, AND CLASSIFICATION OF CHILDREN IN SCHOOL

AFTER giving some general account of childhood and the means of study here followed, I proceed to explain what may be observed in infancy and early childhood as indicative of the **general characters of brain activity**; each such character may in part be indicated by points seen, or nerve signs; particulars for observation of the body, signs of development, health, and growth have also been mentioned.

As you watch children in school you will see many kinds of movement which you cannot at once readily class as nerve signs, or under the headings of the general character of brain activity described in Chapter II., because to some extent these are arranged in relation to the environment. As an aid in rapid observation, you will need terms of description simply implying what you see before you at the moment, without stopping to notice the conditions producing action.

When you see the eyes move to one corner of the room, you may notice the fact without looking for a cause indicating it as spontaneous or not. If the feet are shifted and make a noise, you can look and see

whether this is part of a spreading area of movement passing over the face, the eyes, and also the fingers. Should twitching movements of the fingers guiding the pen attract your attention, glancing at the child's face, you may see ripples about the mouth suggesting laughter; or, on the other hand, twitching of the eyebrows, rapid winking of the eyelids, and a flushed face, expressive of some excitement or mental confusion may be observed. In such cases you may not have time to investigate further, and will be obliged to act without knowing the origin of what you see. Shrugging of the shoulders when spoken to, and often repeated, may be a spontaneous movement, or an indication of mental status; still it should be noted. A succession of movements in physical exercises may be well coördinated in character as seen; but this may be either from imitation of the other children in the class, or really due to established brain impressions produced by practice. Closed eyelids may mean stopping to think, or going to sleep.

Movements may be classed without reference to their cause. Four classes of movements will now be described as apart from the modes of brain action which they indicate, and without reference to their causation. This will aid our descriptions of children as we see them. You must be familiar with what to observe, if you wish to know the children and their varying modes of brain action as you may learn to see them. Thus:—

1. Uniformly repeated series of movements.
2. Augmenting or increasing series of movements.
3. Lessening or diminishing series of movements.
4. Coördinated or regulated series of movements.

Each of these modes of movement has been mentioned in describing the general character of brain action; examples with reference to what has already been said will make you familiar with the points to look for, and give them a further significance when you recognise them in the children you observe.

(1) In **uniform movements** the same parts of the body move in the same way over and over again; this is often seen in tricks or habits such as: turning the head frequently to the same shoulder; nodding the head, or turning it from side to side in speaking; raising the forearm towards the forehead as if saluting; protruding the tongue when asked a question. Some of the subnormal nerve signs described are uniformly repeated movements, such as: horizontal frowning (frontal muscles overacting), repeated knitting of the eyebrows (corrugation), and grinning, which is sometimes one sided. Tapping with the foot on the floor; swinging the knee; drumming with the fingers on the table; twisting the thumbs when unoccupied; or tearing up a piece of paper while talking, — are other examples of uniformly repeated movement. Some of these habits indicate

spontaneity with lack of control; while, inasmuch as they are persistent, they show retentiveness, but of a low type, and want of coördination in brain action. Sometimes they replace spreading movement.

(2) In an **augmenting series of movements** fresh parts come into action as it spreads, the number of parts seen moving increases. Laughter usually begins about the mouth and spreads upwards; but when making observations on children under restraint in schools, I have seen the first indications in twitching fingers, spreading later to the face. A smiling expression of pleasure may, I think, commence in the forehead. A quick, jerking set of movements may be seen when a nervous child is startled on being suddenly spoken to; the shoulders and arms being jerked so that the hands are (involuntarily) pushed forwards, and may displace things from the desk; then the head may be turned, the eyes moved every way, and twitching may spread from the mouth to the fingers. Spreading movement in passion I have sufficiently described (Chapter II., p. 44); the same occurs with display of most of the emotions, and is seen markedly in joy when the child skips with happiness (see Chapter V., p. 96). Stammering consists in a spreading spasm, seen in the lips, tongue, and forehead.

(3) A **lessening series of movements** is seen when quietness replaces the natural spontaneity of action in many parts of the body before class work, subsiding

gradually to the attitude of attention; or, at the end of the day, as activity decreases, talkativeness lessening, expression lessening, and the eyelids closing in restfulness and then sleep. An increasing mode of movement seen previously in passion, joy, emotion, at length gradually subsides to a moderate degree of quietness, or it may be to the stillness of exhaustion without movement. Well controlled and coördinated action (voluntarily) lessens after continued persistence, continuing in fewer parts, which may move more slowly. Thus: expression may begin to fade from the face, the eyes move less frequently to the book, and its pages are hardly turned over. The previously increasing area of spasm in stammering subsides on relaxing effort, leaving the forehead, then the mouth and tongue are relaxed to quietness. In the child recovering from chorea, the area of movements lessens as health improves.

(4) A coördinated series of movements indicates much that we desire to see in the child. Such a mode of movement has a special character dependent upon the time and degree of each component act. When playing a scale of music the fingers are directed by the printed exercise, and move in an arranged order. You may make similar movements of hands and fingers before a class of children, as an exercise for their imitation and practice. Coördinated movements of the hands and fingers are seen in drawing

and writing, and in manipulative work, where each movement is prearranged — just as the notes arrange the hand movements for the music scale. This is practised in sloyd work accurately performed, and in the occupations of the Kindergarten. All these controlled actions in young children are likely to be accompanied by some spontaneity in movement of the head, eyes, and fingers, while still the major part of the work represents coördinated action.

Eye-movements are often incoördinated, wandering, not exactly directed to what is pointed out, or towards what the child is told to look at.

Facial and mouth movements are coördinated in speech with those of the tongue, both when sounds are taught and when syllables are formed into articulate words; expression in the face is similarly controlled by sight in imitation of the teacher. Marching, and the exercises of drill show movements of the legs and arms coördinated with the action of the muscles of the spine and head.

It will occur to you that coördinated action is the essential feature of good games. In the cricket field the boys stand straight and easy ready for the play, the bowler ready, and the batsman prepared to hit and run. Action in the batsman is coördinated by sight of the flying ball, and as he runs by seeing the fieldsmen. The boys who are fielding are regulated in action by sight of one another and of the ball. In

earliest infancy we do not see coördinated action, this is a later development; spreading area of movement occurs earlier. Coördinated action is opposed to some of the subnormal nerve signs described, and forms the best means for their removal.

When speaking of evolution in nature in the next chapter it will be shown that modes of growth are commonly seen in living things occurring uniformly in repetition of parts; in augmentation or diminution of living parts, and also, in action coördinated by the environment. This is one indication that the scientific principles employed in studying living objects and the methods of natural history may be applied to the study of action and mind in the child.¹

Points of several kinds have now been given for use in observing and describing a child as you may see him in school; it remains to say something about health and nutrition, as well as the examination of the senses, which should form a part of your description. In Chapter V. I shall more particularly describe the processes inferred to occur in the brain of the child under observation, showing something of their connection with indications of mental processes, and the abilities and disabilities of children as we find them; thus we shall gradually proceed to describe all we can of the child as we see him in being.

¹ See "Anatomy of Movement: A Treatise on Action of Nerve-centres and Modes of Growth." The Macmillan Company.

Speaking generally, the weight and the height, with the chest girth, are sufficient indications of good growth, and to this may be added some measurements of the head. Children may be fat in face, but otherwise thin; this is frequently the case with nervous children; the body may be large and heavy, with low nerve-muscular power; on the other hand, some children are thin, but wiry, and really strong.

Nutrition in the body may be judged by fulness of the face and cheeks, or plumpness, and by the muscular development of the arms and legs as seen and felt. The colour of the face and lips should also be noticed. The skin should be both clean and clear from sores and abrasions about the angles of the mouth or nose, while the hands are free from cracks and chilblains; the nails are also worth inspection; there should be no enlargement of glands under the jaw or in the neck.

Looking at the eyes, they should be clear and bright, as well as free from all discharge; on gently depressing the lower lid with your finger, its inner lining is seen pale and clean in good health.

A momentary inspection of the mouth will enable you to view the palate and see its form; the condition of the teeth is noteworthy; while the tonsils are seen on each side of the throat in front of the soft palate, which rises as you make the child say "Ah!"

Sight may be tested by using printed test type, which should be provided in every school, and kept clean and

used in a good light; test each eye separately for near and for distant vision.

Hearing you may test with your watch, noting the distance as measured by a tape at which it is heard with each ear. Your voice is a better test, and has the advantage that you can make him repeat what you say; whispered speech should be heard at twenty-five feet. Test each ear separately, and do not let the child see your face, or he may read what you say from your lips.

In proceeding to record a description of your observations, it is important to arrange the points seen as to their kind or significance; this may conveniently begin by describing the body as in the form or chart used here. Such description of the child as we see him in action, together with an account of his school character, renders it possible to discuss the points of the case from several positions.

Many children are described in "The Study of Children and their School Training"; the form of chart here employed I first used in my articles in *School World*.

A CHILD WELL DEVELOPED IN BODY AND BRAIN: MUCH SPONTANEITY, BUT IT IS UNDER CONTROL

Age last birthday. 8 years. *Name.* C. (boy).

A. Body: development, features, etc.

Head. Normal in form and proportions.

Face. Good, well-proportioned features ; all of sufficient size.

Ears. Average ; all parts developed.

Nose. Normal.

Palate. Sufficiently wide ; good teeth.

Growth. Height, $48\frac{1}{2}$ inches. Body and limbs well proportioned

B. Nerve signs : postures, movements, action.

General balance of body. Stands well and straight, full of healthy spontaneity, head and eyes turn everywhere, especially to teacher and the objects on the table.

Expression. Lively, looks pleased and interested. Forehead smooth.

Orbicularis oculi. Good tone in face about eyes ; increased when he smiles.

Eye-movements. Turn well to fix on teacher's hand when imitating movements.

Head balance. Held well up.

Hands. Held out straight in prompt response, the fingers move a little. After hands have been kept out half a minute the head droops to the right, but is quickly erect again when hands are put down. Imitation of finger movements fairly accurate ; response quick.

Indications of modes of brain action.

Spontaneity. Up to average for age ; good tone of face, and is always ready for action or to make some reply.

Impressionability. Present in a degree indicating that he will probably develop good capacity for control through his senses and in coördination.

Inhibition. Is generally quiet during class, and attentive ; after work is fresh and full of play and talk.

Control through senses. Action fairly accurate as controlled by sight of what he looks at.

Muscular sense. Can distinguish the weight of seeds ; also makes measurement at sight fairly well ; counts objects accurately.

Compound cerebration. Not very successful in manipulation, except under guidance.

Retentiveness. He evidently remembers some of the points he has been taught, and performs his physical exercises better than last year. His thoughts do not follow in as good order as his movements.

Coördination. Imitates manual exercise, with fair accuracy as to the fingers moving ; not quite correct in time of action.

Spreading area. No habitually repeated overaction. When a little fatigued, his head droops.

Response delayed. When he answers a question, his reply is prompt, whether correct or not ; there is very little pause for thinking. His replies come out like reflex actions rather than as resulting from a train of thought which occupies some interval.

C. Physical health and nutrition. Healthy and well. Weight, 55 lbs., average.

School report. A very bright but mischievous boy, is liked by his schoolmates. Fairly attentive and interested in his lessons ; reads well, and answers very promptly.

Observer's report on child. A well-made healthy child, with good brain activity. The healthy spontaneity of childhood is well marked ; this is easily controlled through eyes or ears, and resumed in a healthy manner.

when control is removed. There was no excess of extra movement accompanying his action, but as fatigue commenced from the strain of holding out his hands, the head began to droop.

A normal, or healthy, well-made child is known by the development and proportioning of his head and features, and other points which have been sufficiently described to enable you, after some practice, to recognise any subnormal conditions by their contrast with the normal.

The nerve signs, individually and collectively, indicate, like the hands of a clock, what is going on inside the child's head; that is to say, the present working condition of his brain. They may vary on different occasions and under different circumstances, just as mental status may vary.

We must exert our minds in studying the children's brains. It is true that the child tends to imitate your expression, but your thoughts are not his thoughts, the modes of thinking differ; he has not yet acquired your mental faculties and experience; he is childlike, and must be observed carefully if you wish to study his brain action. Observe him under different circumstances, when he is attentive, and when he is disengaged and does not see you, in the schoolroom and in the playground, so you will be able to recognise the general indications of his brain in action, as apart from detailed nerve signs seen in class or otherwise.

In the teacher's mind the best interests of the children should stand before his own; even the natural desire for self-culture in the higher branches of learning ought not to lead him to spend his time to the disadvantage of his class in undue devotion to private study, leading to fatigue. I have seen a school-master, exhausted by night study when working for a B. A. degree, whose pupils in class all imitated the signs of his fatigue and lassitude.

You must train yourselves by constant practice to become good observers. Dr. Stanley Hall and other leaders in child-study have urged that teachers should observe the children after the methods of natural history; to this you add the contents of their minds in each case, and thus obtain a fuller knowledge of the mental action accompanying what you see and hear. The child in mind and body is a part of nature's work.¹

I am here endeavouring to show you what to look at and what to look for, as well as to supply the means of description. If you will look out for each point—and there are plenty of examples in any school—you will acquire useful knowledge that will enable you to draw rapid inferences, and lead to a ripened experience of great value throughout life.

The methods of study here employed will enable

¹ See author's "Mental Faculty," Chapter I. The Macmillan Company.

you to give scientific descriptions of your children founded on observation, indicating what you really see as signs of their happiness, peevishness, fatigue, or nervousness. These methods will further enable you to grasp a high ideal of the teacher's work, as you trace out the modes of brain action indicated by the various mental states of the pupils, and learn to understand their relations to one another and how to deal with them. In your methods of observation and study my experience may afford some help; your methods of management in school must be guided by your own minds and personal study.

Pierre Camper (1792) wrote as an artist, and describes joy and laughter. He says: "In complacency, friendly greetings, and tacit joy, the angles of the mouth must never be drawn up alone, without the tokens of an incipient smile." He thus refers to the gentle spread of movement seen in the face, while the increased spreading action in laughter is further indicated. "In laughter all the effects produced by the former affection are greatly increased, and others are superadded. The whole countenance inclines forwards, but without the attention being fixed upon any determinate object. The muscles around the eyelids are contracted, producing wrinkles and folds around the eyes. The lips are opened, and the teeth, particularly the upper, are made to appear; small wrinkles arise at the corners of the mouth and the cheeks become

fuller." Sir Charles Bell writes:¹ "I hope my reader consents to believe that the capacity of expression is bestowed as a boon, a mark of superior intelligence, and a source of enjoyment; and that its very nature is to excite sympathy; that it radiates, and is understood by all; that it is the bond of the human family. . . . Observe the conditions of a man convulsed with laughter, and consider what are the organs or system of parts affected. He draws a full breath, and throws it out in interrupted, short, and audible cachinnations; the muscles of his throat, neck, and chest are agitated. He holds his sides, and, from the violent agitation, he is incapable of a voluntary act." To such expressions of joy in the child may be added movements of the shoulders, which are drawn up and down, as well as opening and closing the fingers and movements of the whole body by the feet, accompanied by shouting. You thus see much spontaneity, while impressionability is only momentary, not producing control, and all artificial manner is lost (no compound cerebral action); there is a wide-spreading area of action and no delay to such impressions as the child receives through his senses. Movements are anything but uniform, they tend to increase, as in all expression of emotion — ultimately subsiding and become controlled or coördinated again, when the movements are slower with some pauses.

Irritability and peevishness are generally accompa-

¹ "Anatomy and Philosophy of Expression," third edition, 1844.

nied by the signs of fatigue; the natural expression of the face is partially lost, there is often fulness under the eyes and frowning, with pursing or contraction of the mouth, which is the opposite to the expression of joyfulness. Such spontaneity as exists is neither controllable nor capable of inhibition; this is partly shown in disjointed utterances. All established manners (modes of compound cerebration) are for the time lost, while impressions by sight or sound lead to short, jerky, spreading movements. A touch on the shoulders makes him wriggle; his head turns away from his food; he makes no response in words to a question or inquiry, no normal reactions occur. The child should be judged at his best, and not when fatigued and irritable.

Camper, in referring to the descriptions of expression by many authors, says, I think justly, that "they have usually either confined themselves to appearances or have reasoned metaphysically concerning the operations of the mind, without attending to the physical causes of the changes produced by these operations; but in my opinion speculations concerning the manner of the soul's working or concerning the seat of the soul are of no use to the artist. These belong to metaphysicians, who, by the way, lose themselves in a labyrinth of terms, or words with no definite meaning, without having in the least explained the action of this immortal principle upon the compound and mortal frame."

A careful and detailed study of the points observed in cases of brain disorder and in children of mental deficiency, in contrast with those well developed, bright, and active, enabled me to define the subnormal nerve signs described in Chapter III. Thus a number of points for observation are presented, each of which when seen has some significance. The signs indicating brain disorderliness you want to replace by training the general characters of good modes of brain action. Thus you cultivate the excessive spontaneity of restlessness or emotion to become action controlled by guidance, and try to replace the spreading activity of fidgetiness by organised work, and by games; the confusion arising from seeing, hearing, and feeling at the same time, you remove by methodical procedure in looking carefully, attending to what may be felt in handling objects, and in hearing distinctly what is said. (Example in Chapter VIII., p. 103.)

Means are afforded for describing your observations, which indicate physical conditions of the body—the developmental signs and the nutrition of the body; while the state of brain action will afford much information as to some causes of mental dulness and the directions in which you may most effectively try to remove them. It is quite possible, as experience has shown, to discriminate in a school the children whose brains are disorderly and untrained, by observing them without asking the questions necessary for a purely

mental examination; nearly all the dull and backward pupils may be thus grouped quickly as needing your further attention in training, while those well built, with good and healthy brains, are discriminated at the same time. Thus for the purposes of school management and classification you can obtain records of the children with nervous disturbance or incoördination and defective response, as well as those pale, thin, or delicate. Facts thus accumulated, and inferences drawn from them, will afford you a sound experience; that is why you will, I think, find it both interesting and useful to study children after the methods of natural history.¹

A CHILD OF NERVOUS TYPE

Age last birthday. 14 years. *Name.* — (girl).

A. Body: development, features, etc.

Head. Of good volume and well shaped, circumference, 21.5 inches. Forehead broad and high.

Face. Features in good proportion. Eye-openings and mouth of sufficient size.

Ears. Well made in rim and pleat of the ear, alike on either side.

Nose. Normal, breathes with lips closed.

Palate. Sufficiently wide; good teeth, not crowded.

Growth. Height, 60.5 inches (average for age, 60.32 inches). The body well proportioned, hands and feet rather small.

¹ See Reports, References 1, 37, 44.

B. Nerve signs : postures, movements, action.

General balance of body. Does not stand straight or keep quite still. Shoulders not at same level. Feet unequally planted.

Expression. Bright and changeful ; a spreading smile often seen, and sometimes twitching of the mouth.

Orbicularis oculi. Want of good tone about the lower eyelids, but this disappears when interested and in smiling.

Eye-movements. Can fix eyes well, but they often wander when not directed.

Head balance. Head not bent down, but often falls a little to one side or is turned about.

Hands. Held out promptly in response, the left a little lower than the right, while neither is on a level with the shoulder. Each balances in the "nervous posture," especially the left ; this becomes more marked if the effort is maintained ; there are twitchings of the fingers. This action is accompanied by some bending of the lower part of the spine, while the shoulders are thrown back. Response is prompt, action is quick and well imitated from others, but is often accompanied by some extra movements besides those under control.

Indications of modes of brain action.

Spontaneity. Fidgets while standing, feet shuffle, fingers twitch. The head is often turned about, the eyes wander, she smiles frequently, and is active in play.

Impressionability. Quick to receive all impressions ; looks at every one who speaks in the class ; is not always completely under control.

Inhibition. While prompt to stand when directed, there remains some fidgeting of the hands with the dress or hair ; she is never quite still.

Control through senses. Good capacity, but sometimes listens and looks about instead of seeing the black-board or map demonstration. At times starts and fidgets when spoken to.

Muscle sense. Appreciates and compares weights in the hands well; knows coins by feeling them. Estimates dimensions better by feeling with the hands than at sight.

Compound cerebration. Physical exercises well performed; can lead the class without being guided. Proceeds systematically to examine and describe a flower as previously taught. Generally repeats a lesson correctly.

Retentiveness. Memory really good; but forgets where to find things from not looking to see when putting them away; can retain facts learnt, but does not always use them aright.

Coördination. Imitates hand movements well, but is not quite accurate. Such action is often accompanied by some extra movements. Speaks well; good at games.

Spreading area. Extra movements with the pen seen before writing, while at times the fingers twitch on the pen. The head often turns upward while thinking; or is held on one side when speaking, or when the hands are held out. She tends to laughter and talkativeness. Sometimes there is confusion in replies; facts of history are remembered but given in the wrong places.

Response. Quick both in action and in words; generally without a pause for thinking.

C. Physical Health and Nutrition. Not pale, but a little thin for her stature; weight, 98 lbs. Average weight for age

is 100.32 lbs., but the child is a little above the average height ; further, she has probably not yet completed her growth which last year increased by 1.75 inches as against an average of 1.57 for her age, while weight increased only 8 lbs. as compared with the average which is 9.14 lbs.

School Report. In disposition affectionate, sometimes loses self-control, becoming emotional and passionate.

Observer's Report on the Child. This girl is well developed in head and features, as well as in bodily growth. There is a little asymmetry in nerve-muscular action ; some tendency to spreading activity in the brain, both for movement and thoughts, and as this is not always under control we see what are commonly called some signs of the nervous type.

Mental capacity, as is usual with these children, is quick and the memory retentive, but expression is not always exact.

She is a little pale and under weight ; general health culture together with continued training are needed. Her condition is hopeful, but she might easily be spoilt, becoming anæmic and dyspeptic if health is not cared for, or neurotic and excitable and hysterical if not properly controlled during the next two or three years ; while under bad hygienic conditions some permanent ill health is likely to arise.

CHAPTER V

EVOLUTION OF THE CHILD AND HIS BRAIN POWER

THE child grows, whether he be trained and educated or not; the brain grows with the body, and some of the characters of brain action will develop, producing either good, bad, or indifferent work and character in the future. The mode of evolution much depends upon home life and the care taken in school.

It is too often supposed that the brain acts well or badly, is fatigued, excited, or sleepy, as a whole; thus assuming that all its parts are in the same condition. Your understanding of the brain in action, as inferred from what you see in the child, will be greatly aided by constantly bearing in mind that the bits of brain—or brain centres, as we call them—act more or less separately, as well as in collective groups. Thus, the brain, as a whole, may be compared to a regiment of soldiers on review; each man, company, and battalion, has orders to carry out; the men in the company act together, their united action being directed by the officers, and the whole manœuvre by the colonel of the regiment, who receives his orders from the War Department. It is essential to remember this separate action of the

brain centres when trying to understand the general characters of brain action indicated by your observations. The brain is an aggregation of nerve centres, much of whose action is expressed by the movements they produce and which we see; while further modes of their interaction among the nerve centres may be inferred from observation.

It is now commonly accepted knowledge that some kind of evolution occurs in nature, generally to the improvement of the race; the same is seen in families, and with the advancement of a child if placed under favourable circumstances, so that happily the children often attain to a higher physical and mental standard of development than their parents. We usually see the children in a family bearing a strong resemblance to one or other parent in some points; at the same time there are often marked differences in the characters of the members of the same family, with improvement upon their inheritance in some particulars. It results, that in a family, as in a school, many varieties of children may be seen, differing in type of features, in health, and in their brain characteristics.

Again, the individual child changes much as age progresses, and his brain faculties evolve; character is formed under training and guidance, the natural tendencies may be developed or in part suppressed, and mental character thus improved.

Physiological terms of description in child-study en-

able us to appreciate resemblances and differences; mental status may thus be compared and traced in evolution from childhood to manhood—sometimes with periods of reversion to childishness.

Does laughter express joy, and crying pain or sorrow? We see that laughter indicates a spreading mode of brain action; so does crying, as the emotional storm spreads—hence the kinship between laughing and crying; the one may pass on to the other in the expression of emotion. (See Chapter III., p. 51.) Among children too much similarity in manners and in expression may result from a limited experience, that is, from too little freedom; this dwarfs the evolution of individuality. Insufficient control by varied surroundings leads to the formation of but little of the real character, which results from many experiences received and retained. Mental evolution is seen in the acquisition of knowledge and fixed trains of thought, as also in retention of the impressions necessary for comparison, and the terms employed in description and as aids to memory; these impressions interact in the brain.

I hope the reader has seen for himself many of the facts that may be easily observed in the movements and response of the child; this will prepare the way for a ready appreciation of what has here to be explained as to the evolution of mental powers, as far as they can be traced among the nerve centres of the brain.

The principles of evolution as the methods of nature led me to look for a classification of processes of growth that might be arranged in the same manner as for movements, and the modes of brain action corresponding to mental expression; it seemed probable that all modes of evolution would have some resemblances.

The study of observations in plants and animals showed me that there are many points of analogy between growth and movement, which throw light upon the understanding of each.¹ In child-study you will soon be convinced that healthy growth of the head and body are usual accompaniments of good brain power seen in movement and response.

These principles of natural history may be applied by way of illustration to the description of movements, arranged in four classes, as given in Chapter IV. Each class of modes in growth among the parts and structures of plants as here given has its analogy in the classes of movements before described.

Uniformly repeated growth resembles uniform repeated movement in the order of the events occurring with but little variety. Look at a young sprig of ivy growing on a smooth wall; leaf after leaf has grown similar in shape and in size, each leaf arises at equal distances apart; this looks simple as compared with the developmental growth of buds and flowers. Nodding

¹ See Author's "Anatomy of Movement: a Treatise on the Action of Nerve-centres and Modes of Growth." The Macmillan Company.

the head repeatedly is a simple movement when compared with writing a letter.

An **increasing number of parts growing** is seen in the development of a chestnut bud where the inner scales grow longer, the axis elongates, leaves are formed, and finally a number of flowers are produced. The new shoot bearing flowers is a wonderful development from the bud, with many new parts ; compared with the ivy sprig it is complex, owing to the number of new parts that have grown in various forms. A greater amount of nourishment is used in the shoot producing leaves and flowers than in the twig that grows only a few simple leaves. Any increasing amount of movement in the child is due to a spreading area of brain action, and indicates an expenditure of its force.

A **diminishing number of parts** is found in the buttercup flower as time goes on ; the yellow petals fall, then the green sepals that enveloped the bud before opening ; the little stalked stamens fall off, leaving only the parts in the centre (carpels) which form the fruit and contain the seeds that result as the outcome of flowering ; the parts that have been useful disappear and leave the perfected fruit. In the child we have seen examples of much movement subsiding ; when there has been a display of emotion but little effect in the brain remains except some fatigue, from the large area or number of parts that have acted. After the performance of a well-regulated exercise, the quieter action following is at-

tended by a more perfected organisation in the brain, of use in future action.

Coördinate action is seen in the movements that occur in the leaf of the sensitive plant (*Mimosa pudica*). When the plant is in its natural state and in the light the leaflets are expanded horizontally; but after a touch they become folded, and at length the main stalk is depressed, so that the entire leaf falls down. If two leaflets at the extremity are touched they fold upwards, and a similar movement takes place down the stalk to its base, and then spreads to adjacent stalks, each successive pair of leaflets becoming folded in order. Thus you see coördinated series of acts, started by a slight touch but passing in a regular order, owing to the structure of the leaf in which the cells producing movement are specially connected with one another. In darkness a similar kind of movement occurs, with the result that the leaves are protected from being chilled at night.

You see how modes of growth may be uniformly repeated, they may spread, diminish, or be controlled by circumstances, and so become adapted to the environment; this is analogous to what we saw in movement, which may indicate brain action recurring in the same area, spreading, diminishing, or controlled by sight or sound.

You must ever bear in mind that each movement in the child indicates action in a nerve centre; while a

series of movements expresses the action of a group or series of centres, so we can trace out the modes of brain action and their characters by observing classes of movements.

Further illustrations of this subject I have given in my former works¹ with catalogues of a museum demonstrating some of the principles of natural history as they may be applied to the study of the brain and the body of the child.

Having spoken of natural history as illustrating the principles of evolution, I will give a few illustrations of reversion to earlier conditions. Some seedlings of the *Mimosa pudica*, or the sensitive plant, were potted off into different earths and sands. Those planted in a soil of two parts of decayed vegetable mould to one of sand grew more vigorously both in height and foliage than the others; and after two months growth they were much less sensitive than others planted in two-thirds of silver sand and only one-third of leaf mould. One or two plants were grown entirely in silver sand. These showed extreme sensitiveness to the slightest touch; even a breath of air, or the slightest jerk of the pot in which they grew, caused all the foliage to shut up. It also appears that the plants may become accustomed to a weak stimulus. Thus, Desfontaines carried with him a sensitive plant in a coach, the jolting of which caused the leaves to close, but ere long the

¹ See Author's "Anatomy of Movement," "Mental Faculty."

plant became accustomed to the motion and the leaves expanded.¹

Here are facts worth remembering. They may help to show you how best to care for the bodies and brains of children who are overmobile and sensitive—they must be properly fed, and under a wise training they may become accustomed to the trials and joltings of daily life.

Reversion to childish modes of action is not uncommon; these may be seen in the attitudes and gestures of the body, such as hanging the head as if too heavy to support, in place of keeping it erect; bent knees and elbows in listless attitude like the position of the limbs of the infant (see Chapter II., p. 24), also in the closed hands in place of fingers open and ready for action. Childish reversion is seen in spontaneity, not impressionable, but tending to spread, especially when accompanying indications of lowered nutrition. This is characteristic of exhausted and nervous children, also of those untrained to self-control and regulated habits.

I have referred very briefly to some facts in natural history illustrating principles to be used in studying the evolution of brain power, and now proceed to speak of changes which appear to take place among the nerve centres in the development of mental processes, so that you may acquire some understanding as to what occurs in the heads of the children.

¹ Balfour, "Class Book of Botany," 1871, p. 496.

We have seen that spontaneity may be temporarily arrested and then replaced by a new coördinated action ; the child when spoken to stops fidgeting, thinks, and then does as directed. (See Chapter II., pp. 36, 39.) We cannot admit in physiology that this is produced by the will or the mind, but must infer that it indicates an arrangement among the brain centres, through which they become united by nerve paths. The brain centres, though they can act separately, may become united by the formation of nerve paths between them so as to be readily called into coaction, corresponding to mental action or its expression ; larger groups may be so connected as to act in unison, or in a series one after the other in an established order (coördinated action). Thus the pupil repeats the words of the lesson he has learned. The action of a single centre, or of a group arranged as a series, may be started by a slight impression, — the sight of an object or a gesture, or the sound of a word of direction. (See Training, Chapter VII., p. 143.)

Let me refer to the analogy between the brain with its parts or nerve centres, and the regiment of soldiers on review. The men have previously been drilled in squads, and trained to act together as one group ; many such groups move separately when the formation of the company changes. The squad corresponds, in our analogy, to a group of nerve cells united by nerve paths, resulting from repeatedly act-

ing together. The command of the colonel communicated to the officer of one squad is passed on to the rest, or given to each separately, by an aide-de-camp, so that two or more squads act together, or they may fire alternately.

Regimental formations may be prepared without firing, or a spreading line of fire may be ordered. The nerve centres may be arranged by new nerve paths, while the child is listening attentively. Expression comes later, when he repeats what he has been taught. In battle, if panic or loss of the officers of the army dissolves the organisation, each man acts alone and spontaneously, and disorder or confusion result.

The metaphysical side of psychology I must leave alone, while directing your attention to evidence obtained by scientific observation of the facts expressing the modes of brain action essential to thought and its expression.¹

All expression of mental action is by movement. We do not know in what way consciousness and mind are connected with the brain and body; still it is true that all mental action in one person is *expressed* to another only by some form of movement. Thus, we express our thoughts in the movements of articulation, in speech, by facial expression and gesture,

¹ References 6, 14; and *Journal of Mental Science*, London, April, 1889.

or by the written words produced by movements of the fingers as guided by the brain. In each case it is the nerve-muscular mechanism that indicates or expresses the thoughts arising in the mind; it is the brain centres, acting on the muscles of the body and limbs, that convey to another person the thinkings that occur. Movements produced by the muscles are thus indices of what goes on among the brain centres that produce them; still, the processes of thinking can go on in the brain without being expressed.¹ The hands of a clock indicate the time as we see them move; the clockworks produce the movements, and these will go on just as well if the hands are removed, only we cannot read the time then; it is the clockworks that keep the time, and the hands that express it visibly. We mostly study our clocks by observing the movements of the hands, but the clockmaker is able to look at and understand the works.

In employing scientific methods for studying mental action, as it occurs in the brain, we observe movements and class them as already explained (see Chapter IV., 75), and describe them; then, just as in other scientific research, we proceed to draw inferences from observations, and formulate a working hypothesis as to modes of mental action in the brain.

¹ See *Proceedings of Congress of Education, Chicago*. Reference 34.

It is probable that the nerve mechanism for thought is the highest set of nerve centres in the brain; these are connected in structure with the lower centres, and finally with the muscles that produce the movements of the limbs and parts of the body. Thus the nerve-muscular system produces action, such as is commonly called voluntary. I desire to explain the correlation of mental action with other natural processes, and to trace out the effects of conditions around the child in so far as concerns us in dealing with training and education—not as a means of explaining what mind consists of, which we do not know. The study of mental action in the brain thus becomes a study of physiological processes; hence, I employ methods similar to those used in observing specimens in natural history showing growth and movement.¹

We have seen in the evolution of the infant that a pause in spontaneous movement after an impression by light or sound may be followed by a new coördinated act. We infer that during the pause or inhibition of movement, the brain centres are united by temporary nerve paths, and thus prepared to act in a series producing the action seen. This is the sort of action occurring in the brain of the pupil during quiet attention, in looking or listening, rather should I say the period of orderly preparation of nerve cells by the light or sound. (See Chapter III., p. 69.)

¹ References 5, 14; *Journal of Mental Science*, April, 1889.

In training the pupil to imitate your pronunciation of a word you make him look at you; the child then makes movements similar to those of your lips and face.

We infer that, as the result of the impression by sight, the same centres that are active with you are acting in his brain. Further, after repeating the word a few times, if the child can say it without guidance, we infer that the brain centres for that word have become connected by nerve paths, so that the syllables are pronounced and the impression in the brain is retained. Analogous brain organisation is built up by physical exercises in imitation of the teacher, thus making the brain grow apt for connected mental action. In such training, action becomes more exact by practice, then quicker; finally it can be produced by the child without your guidance, simply on directing the pupil to do so. We do not see this coördination or brain evolution in the very young infant, in the imbecile, or in the sick child.¹

From the study of numerous observations and inferences drawn from many and varied facts, I was led to conclude that a thought, or mental act as it occurs in the brain, is there represented by the activity of a certain group of nerve cells (diatactic union)²—the brain centres forming the group acting in a definite order as

¹ References 29, 52.

² See "Mental Faculty," Chapter III.

determined by the nerve paths formed between them by sensory impressions.

It is here suggested that a mental act is due to the function of certain brain cells, temporarily connected for the action; on another occasion different arrangements may be formed among the same nerve cells, and a different kind of mental act result. Thus the brain cells become temporarily connected by nerve paths, leading from one to another, which are formed by impressions received in the brain through the senses and by muscle sense (see Chapter II., 37). The arrangement of the brain cells (diatactic action) for this kind of concerted action occurs during the "pause" or period of inhibition of movements, to which I have often referred, as corresponding to attention or the period of thinking. Training as described in Chapter VII. makes the brain centres apt for this kind of action.

In illustration let me again refer to the analogy of brain action and the organisation in an army. In order to achieve a certain object the colonel orders a company of men to make a particular movement in concert; on another occasion the same men may be arranged in different divisions to execute a further purpose.

In a city possessed of a good telephonic system, six merchants may be placed in communication by an arrangement of the electrical wires; at another time five bankers may consult and act together, if the arrangement of the wires is adapted by the

superintendent of telephones who receives an order to do so. The city is then roughly analogous to the brain. The telephones represent brain centres, the order given to the superintendent corresponds to sensory impressions. These orders result in certain telephones being temporarily connected by electrical wires which bring them into communication; these wires are analogous to the nerve paths formed between the brain centres. The nerve centres, by the formation of nerve paths, are prepared to act in unison and in harmony with the impression that controls them.

In considering mental acts as represented by the corresponding physiological action of brain centres, we study what may be inferred to occur in the brain from visible expression in the child. Coördinated movement indicates nerve centres acting in a certain order under control; if this is repeated without help or guidance, we infer that training has already established some new nerve paths in the brain.

It was desirable in Chapter III. to describe the general characters of brain actions separately; these, however, often occur together in varying degree under different circumstances, and thus become components of a mode of brain action as seen in a child; a few examples will illustrate this.

Impressionability of the brain is shown in various ways, sometimes by arresting action, or in a higher form by guiding it.

Impressionability to the sound of the school bell is seen together with coördinated action, as the boys put their tops into their pockets and run indoors. Some of the boys, however, look up to see if the master is coming, and then go on with their play; here the first impression is followed by action, while the second impression removes the stimulus of the first. Other boys get off to a corner of the playground where they may not be seen. This is a kind of coördinated action that should not take place. Some children simply stand still and do nothing when they hear the bell; the impression produces inhibition only. A deaf boy continues to spin his top as before; he does not hear the bell. One boy makes grimaces, stamps on the ground, throws down his top, picks it up again, drops it into his pocket, and finally goes into school; the impression by sound leads to extra movements with a spreading area of brain activity followed by coördinated action.

Inhibition of movements may occur with or without attention. A pupil is looking all over the room, both his hands and fingers moving also. Teacher says, "Look at this flower as I show its parts, and name them." His eyes are fixed on the specimen and his movements stop, there is inhibition of movement for the time; we infer that his brain action was arrested only as to movement and not for mental process, because he can subsequently repeat the names of the

parts of the flower as taught; inhibition of movement accompanied an act of attention. Another child, when told to look at the specimen, looks at the teacher only, and keeps still; afterwards he can give no answer. His impressionability is shown by inhibition of spontaneous movements, but his brain centres were not controlled by the teaching given, and no mental action follows. Another pupil when told to examine a flower looks at it quietly for a moment, thinking what to do, then separates and arranges its parts. Temporary inhibition leads to co-ordinated action.

The pupil, if sufficiently educated, when he has arranged his specimen on a card, will proceed to write the names of each part and compare them. This shows quiet coördinated action with retentiveness of names and their association with objects; sight of his specimen leads to mental comparisons and description.

Coördinated action produced through the senses in training a child possessed of the faculty of memory or retentiveness leads to the establishment of the nerve arrangements in his brain for many modes of complex action. Practice makes him more apt in performing difficult exercises, whether they be in movement or mental in character.

A child hears his father's footstep and runs to meet him, smiling, gesticulating, and making glad

sounds; this shows coördinated action with extra movements. Another man's footstep does not produce the same result; we infer that the child knows the sound of his father's walk: on many previous occasions that particular sound has been heard, and such impressions have been retained. Our knowledge enables us to infer that this particular sound has produced nerve paths in his brain, associating it with many previous impressions. Vocal impressions may produce analogous results. It is seen in this example that extra movements may accompany coördinated action; usually, however, coördination necessitates some diminution of spontaneity. Thus, a young child out for a walk in the fields runs here and there, shouts, and moves his arms much, occasionally stopping at sight of a flower to pick it. When you call him, he is quieter and runs to you.

Inhibition, coördinated action, and retentiveness are cultivated by practice. In the cricket field the boys stand straight and motionless, ready for fielding; the bowler, ready with his ball; the batsman, prepared to hit and run. Action in the batsman is regulated by sight of the flying ball, and as he runs, by the men fielding. The fielders are controlled in action by the sight of one another, and of the ball. Good play is only gained by practice.

Compound brain action, or preparation to perform a certain set of actions one after another in due order,

is only evolved gradually after much training; culture in various kinds of coördinated action at length renders the brain apt for such acquired functions. As an illustration, give the child two beans, telling him to measure and compare them. He takes one and holds it lengthways between his finger and thumb, looking at it from end to end. Then he holds it flatways and looks at its breadth; finally he holds it from side to side. Again, he takes two beans, one between the finger and thumb of either hand, then places them across one another and looks at them. At last he says, the bean is longer than it is broad, and the breadth greater than the thickness. Impressions derived from previous teaching arise to activity in his brain in due order, they interact on one another, leading to expression in action and words.

As an illustration of more advanced mental power and memory, dependent on retentiveness of modes of compound brain action, let me give you one more example: A boy is told to draw a map of the United States; he proceeds quietly to rule on the paper the lines of latitude and longitude; then draws in the boundary lines, the rivers, and marks the towns, writing in their names. As you watch him you see a long series of complex movements of his hand and fingers, which result in a sketch of the map asked for. The boy's brain has been trained to receive impressions and retain them in order, with

nerve paths among the groups of nerve cells, — analogous to the wires between the telephones, — so that when directed to draw the map he proceeds to do so from memory.

Retentiveness of brain impressions and their association gives the power of memory as the mental faculties are evolved. A child who cuts his finger with a knife feels the pain, he sees the blood and the knife; another time he avoids the knife. The boy bitten by a dog is afterwards frightened at the sight of a dog. A child who has been run over and hurt shows signs of fear when crossing a crowded road as long as the brain impression produced by the accident remains. Thus in the progress of life a child learns and retains much from his experience.

Compound brain action is a most interesting process in the evolution of the child (see Chapter II., p. 39). When he does as you tell him and repeats a lesson from memory it is possible to trace what occurs; the centres corresponding to each word having been impressed previously in a certain order, we infer that they have been connected by nerve paths, and are reactive in expression one after another. The lesson may have been learned and then forgotten, or the impress of a word here and there in the series may have faded; if you supply this, he goes on again to the end. Of course, this process as described is merely repetition without any added brain action for thought.

I have spoken of impressions in the brain corresponding to movements and words; it is generally accepted that words may correspond to (or be coupled with) thoughts, while the thoughts are expressed by words.

Words are produced in writing or speaking by fine and coördinated movements of the fingers, or the mouth and tongue, etc. Like all other movements, speech can be taught; the impression of a sound on a child's brain may form a centre for the word among the nerve cells and a meaning may afterwards grow up around it. You may teach the word, give an impression, and couple the word and sensory impression. You may teach the word "heavy," then produce tension on the muscles of the hand by weights, and, again, couple the term "heavy" with the feeling of weight.

I believe that a thought corresponds in the brain to the formation of a group of nerve cells by nerve paths proceeding between them, thus constructing a new nerve centre out of, or among, existing nerve cells. In analogy to the army, it is as though the healthy, active soldiers of the regiment were standing at ease; the command of the officer of the first squad calls them to attention; it inhibits their talking and laughing, they make their proper formation; they are now ready to act in unison, to make a new formation, or respond to command. The word of

command controls them; they may remain quiescent or express their force in firing (see Voluntary Action, Chapter X., p. 199).

Order and method in training and teaching aids evolution of the brain in the child; disconnected teaching and verbal instruction without previous preparation leads to mental confusion and weakness. It is not in accordance with good method to teach addition till the child can count objects, or proportion before he can appreciate the relative degree of his impressions. Comparison cannot be made without separation or abstraction of the impressions to be contrasted from the mass of impressions received; and this mental process is acquired only after methodical training. The pupil who has examined peas and beans must learn to separate his impressions of weight from those of colour, or of dimensions, before making comparisons and giving descriptions. He will then be able to compare the peas and beans as to their colour and their weight respectively; while he may proceed to compare the dimensions of the bean.

The child grows and the brain grows during school days, so that nearly the full weight of brain is attained by twenty years of age. The brain organisation and condition need training during this period; if education be neglected, as the bulk of brain increases some parts are left incoördinated and too ready for the display of nerve storms, emotion, and hysteria.

It is true that the surroundings of nature in the country, and occupations in social life without artificial education for the children, may produce fair mental ability; but this is at least leaving much to chance circumstances. To let the child's brain grow without bringing it under control is analogous to enlisting a number of men untrained in military discipline, then calling them an army, and expecting them to confront the dangers of battle with success.

CHAPTER VI

PHYSICAL CARE OF THE CHILD; HYGIENE AND FEEDING

A BODY healthy in its organs and parts, including, of course, the brain, is essential to the healthiness of the life of the child, and requires constant thoughtful attention at each stage and in the daily hours of education. It may be convenient to speak of bodily health and brain healthiness separately; but they do not stand apart, each reacts on the other. The brain is dependent upon the body and its organs for a good supply of nourishing, pure blood; the brain acts upon all parts of the body, the heart and the organs of breathing and of digestion.

Thus delicate children need brain training adapted to their individualities, not only that they may have well-formed and balanced minds, but also, in order that the brain may be cultivated as far as possible, to act regularly in controlling the bodily health.¹ Loafing is not good for either brain or body; untrained emotional disturbance upsets digestion; habitual slowness of action leaves the circulation sluggish; mental excitement disturbs many of the organs. The training of a delicate

¹ References 27, 28.

child should not be neglected, but adapted to the special requirements of the case.

Let me explain a general principle in physiology as to the control exercised by the organs of the body upon one another. Physical exercise quickens the heart's action, thus increasing the circulation in the brain and promoting its healthy activity. The sudden call to repeat a lesson in class may excite the brain and produce such disturbed action of the heart as to quicken the pulse beats and interfere with the brain circulation, leading to mental confusion. Again, words of reproof from the teacher may produce a state of mental excitement, while this brain disturbance (spreading action) excites the heart and so disturbs the circulation; then sleeplessness at night may follow. The heart acts on the brain, and the brain reacts upon the working of the heart.

It is said the healthy body helps to make a healthy brain; it is also true that a well-regulated brain helps to keep the rest of the body in good health. Healthy lungs and good breathing afford a supply of pure blood to the brain. Emotion and excitement disturb breathing; the movements of the chest become quick but shallow, and the circulation is impeded; careful training may render the child less emotional, and less liable to this cause of brain disturbance. Food and a good digestion are necessary to produce a proper quality of the blood; regu-

lated control of the brain promotes good digestion. Where you have seen that the child's school work is unsatisfactory as the result of some form of indigestion, it is useful to remember that good digestion is promoted by a proper mental control of the brain, regulated in all good habits. Nervous dyspepsia, as it is often called, may sometimes be prevented or removed by regulation of the occupations and the work of the day, together with punctuality as to the hours of sleep.

These facts are true; they may seem paradoxical; I speak of them here because I think you should understand every side of this question in all instances, as bearing on the responsible care of the child's well-being in every aspect of the case.

The child may be cross and peevish as the result of illness, or want of food and rest. He may be out of health with low power of digestion and want of proper sleep, resulting from lack of occupation and interests, together with habits of getting whatever he wants and eating whatever he fancies; such bad training necessarily leads to ill health and peevishness.

When a child is fidgety and shows signs of fatigue, it is desirable to try and find out the true cause. Weariness from real work may thus lead to fidgetiness; on the other hand, exhaustion may result from spontaneous, or self-originated, uncontrolled, thinking

and imagining, such as is not uncommon among lonely children at home. . In some cases this cause of weariness and fatigue may be removed by wisely regulated school training and occupation in systematic habits of work. The child will not eat his meals, is talkative, and looks at everything but his food ; showing overmobility and the signs of nervousness, while lacking in healthy strength and energy through insufficient nourishment. When possible make him eat, even if his dinner occupies an hour of your time. Some children do not go to bed at their proper time, because they do not sleep ; that is bad management, and often the child is too tired to sleep well the next night.

Thus, conditions of the body act on the brain, and the brain reacts on the general healthiness and nutrition of the child. The points here touched upon are sometimes neglected, thus leading to confusion in management ; while in some instances the child is expected to correct his own faults, although he has not been controlled by those whose duty it is to train him and to try to understand his difficulties and his character. The care of the child's body is our business ; he needs at first to be trained by what is done for him, and taught good habits,—eating properly what is given to him, keeping his hands clean, changing boots when wet, and many other necessary habits in personal hygiene which he can learn to do for himself. Except

in such duties and habits, the less the child is conscious of his own body the better, especially as to pains, appetite, irritability of the skin and throat, or dress, etc.; what he sees and hears should occupy his attention rather than his own sensations.

Clothing should be adapted so as not to interfere with free movements of the limbs and the chest, avoiding either a collar that rubs the neck, or a band that constricts the waist. Woollen garments next to the skin are much to be preferred, and help to prevent catarrhs in winter; it is equally important that they should be made high at the neck, with the object of keeping a uniform layer of air around the body and limbs. Boots should allow movements of the toes, which if unconfined tend to healthy spontaneous movements such as are seen in the infant, but too little in the feet of adults; care should also be taken that boots do not press on the instep, which may lead to "flat foot" and loss of all gracefulness in walking, and even lameness in after years. Dress, while suited to the family of which the child is a member, should not be such as to attract the attention of the child or of others. Perhaps a school cap or badge helps to promote a feeling of comradeship as belonging to a corporate body, whose honour must be maintained by proper conduct outside the school. Dress may be well arranged without being costly, and should be adapted to its uses; while boys, in

particular, need to be encouraged to keep their clothes clean.

One important consideration in school management must be a time table, and a plan of the day's occupations, arranged for each class to some extent according to the ages of the pupils. We have to keep the child growing in body and brain by feeding and culture; work, play, and sleep have to be arranged for, and fill up a large portion of the curriculum, each item of which bears on the others. Sleep concerns the health of both body and brain. Sleeping rooms should be well aired during the day, and ventilated at night by a partially opened window; a night passed in a close atmosphere poisons the lungs and the brain, becoming a fertile source of fatigue, headaches, ill health, and anæmia. (See Chapter I., p. 5.) Dark blinds aid sleep; the drawing up of these in the morning is a better manner of awakening the child than knocking at the door or calling him; light gradually recalls the brain to its daily activities.

As you look at a child in sleep, while as yet there is no light shining on him, and no sounds impressing hearing, the body is motionless except for the movements of breathing. The brain centres are quietly and uniformly nourished by the blood circulating among them. As sounds begin in the house some movements may occur during sleep, showing that some nerve

centres are being stimulated. When light is admitted at the window, the eyelids are first screwed together, then opened; stretching movements are seen, the limbs are moved, the child sits up and begins to talk; the whole brain is now awake and ready for the activities of the day. A gradual method of arousing from sleep is better than a sudden noise; the brain should be allowed a few minutes for recovering its full activity and for restoration of the full circulation of blood which this necessitates. With children who are at all delicate the process of arousing should be gradual, let the child sit up in bed and get fully awake before jumping out; to startle a child on awaking sometimes does harm. A cold bath assures full wakefulness; it helps to stimulate the breathing and establish a good circulation.

It is hardly possible to say how many hours sleep an individual child requires, but the method of sleeping should be looked to. Means should be taken to ascertain whether the child soon falls asleep; cold feet delay rest, a bed too warmly clothed may lead to restlessness, thinking and imagining may keep off sleep. For the habitually bad sleeper a glass of milk and a biscuit may be provided.

The following table drawn up by Dr. Clement Dukes¹ expresses his experience as to the amount of sleep required by children:—

¹ "Remedies of the Needless Injury to Children." Messrs. Rivington, London.

AS WORK AND SLEEP SHOULD BE ALLOTTED

Age.	Hours of Work per Week.	Hours of Sleep per Night.
Children between 5-6	6	13½
“ “ 6-7	9	13
“ “ 7-8	12	12½
“ “ 8-9	15	12
Pupils between 8-10	20	11½
“ “ 10-11	25	11
“ “ 11-12	30	10½
“ “ 12-14	35	10
“ “ 14-15	40	9½
“ “ 15-17	45	9
“ “ 17-19	50	8½

This includes time devoted to study and chapel on Sunday; some will think the hours of work rather long.

In the boarding school the arrangement of dormitories demands attention. Cubicles are favoured by many as a proper arrangement; this plan, however, presents grave objections. As to the desirability of partial isolation as a means of providing some privacy, any schoolmaster or mistress can form an opinion; but there are distinct sanitary disadvantages which must follow such a system. No fair circulation of air can occur around the bed, while draughts are not prevented. Wooden partitions cause further difficulty as to keeping the floor clean in a limited space. A bath should be used daily cold in summer, tepid in winter; when this is impracticable, at least the body should be washed.

Besides attention to toilet, and cleaning the teeth, the eyes, ears, and nose, the child should be trained to take a few deep breaths on rising in the morning; full expansion of the chest helps to restore a quicker circulation in the brain, which is lowered during the hours of sleep.

Healthiness of the eyes must be cared for, in the first place, by keeping them clean and bathing with water in washing; all discharge from the lids or soreness of the margins specially require care in this matter. Any discharge from the eyes seen in school should not be removed with the pocket handkerchief, but with a piece of lint or cotton wool, which should afterwards be burnt.¹ Practice in distant vision is useful, especially for children in towns; this relaxes the muscular apparatus inside the eyeball, and gives the eyes healthy exercise. Let the child look up the street, watch a horse till 'out of sight, look at distant spires or tall buildings, or up to the sky and see the clouds or the sunset glows. In the country the flight of birds, distant hedges and trees, or the course of the river may be followed, while the stars are seen at night. Among objects to look at let me mention the good effects of casts of statuary, busts, and full figures which should adorn the schoolhouse as well as the college. Pic-

¹ See "Study of Children," Chapter XII., on Health Management in School.

tures and wall drawings give colour as well as form; with large figure photographs the eyes in following the lines of the face and the features receive training of real value; things of beauty train the sight as well as the taste.

Small-typed books, especially stories badly printed on cheap paper, tend to hurt the eyes by producing very indistinct impressions. The book should be held steady in reading, and the body quiet; do not let the child read in a rocking chair at home.

In school there should be plenty of light to each desk; indirect sunlight is best, and where possible the light should fall from a window on the left-hand side so as not to throw a shadow of the pen on the letters written. At night a shaded lamp is preferable to a candle, but the rest of the room should not be left in darkness. The eyes should not feel fatigued with reading; the child ought not to be directly conscious of his eyes, any more than of his hands and stomach; muscular and even brain fatigue in moderate degree may be healthy, but eye fatigue means something wrong.

The schoolroom as a place of education should be adapted to the purposes of child growth and brain culture under healthful conditions, among which light, air, and cleanliness are primary necessities. Of lighting I have already spoken; let me add, the windows should be cleaned every week. The air of the room needs

to be changed frequently; organic matter breathed out from the lungs is highly poisonous, this becomes diffused through the room so that the whole atmosphere needs to be changed frequently by partially opening the windows, which should be thrown widely open during the intervals of school work. Lamps and the fire help to consume the oxygen in the room, but it is the human lungs that mostly vitiate the atmosphere and render it harmful to the body and the brain.

A healthy condition of the blood demands proper feeding and digestion, while for its purity fresh air and oxygen are needed in abundance.

Oxygen is necessary to almost all forms of living things; even the lowest forms of animal life, such as amœbæ, lose their activity and life when deprived of oxygen. Brain cells and other tissues of the body are as sensitive as these amœbæ; the energy they display depends upon temporary storage of oxygen, which when again set free produces force. Oxygen is also stored in the blood in the tissues and in the muscles; the red substance of the blood (hæmoglobin) readily absorbs oxygen in the lungs, while the circulation of the blood carries it to the brain, the muscles, and all parts of the body; in so doing it aids processes of digestion and assimilation. Pure air containing oxygen, as it passes over the surface of the body and through the nose, promotes health; hence the importance of a clean skin. Plants kept in rooms need to

have their leaves washed that they may absorb gases from the air. The atmosphere of a room may become poisonous, not only from the amount of oxygen which is being consumed or used up, but also from the accumulation of waste materials thrown off by the breath, which when re-breathed from the air poison the blood and the brain.

As to the temperature of the room Dr. Burnham¹ says: "In this country [America] it seems necessary to have the temperature of the schoolroom nearly 70° F. It should never exceed this; and with adequate ventilation may be less." I have often found schoolrooms too hot and enervating when above 62° F. Plants grown at too high a temperature become delicate; with insufficient light and air they become ill proportioned, long in the stem, with small, pale leaves; they produce flowers, but the plant loses stamina, and the power of resisting adverse circumstances is lessened. Let the pupils see plants growing healthily in the schoolroom, kept clean, watered, placed in the light, and well aired daily. Thus the children may learn something of practical hygiene, as they see how we keep plants growing and healthy.

Much has been written as to the construction of the best form of school-desks. When these are provided, it remains for the class teacher to see that they are properly used by the pupils.

¹ *Pedagogical Seminary*, June, 1892, p. 31.

The following practical directions are given by Mr. Priestley Smith:¹—

“The pupil must have a comfortable seat with a support for the lower part of his back. He must work at a sloping desk, not a flat table. He must be so placed that there is plenty of light upon his work, and that he is not dazzled by light in his eyes. His books must be printed in good, large, clear type, so that he may be able to read them without the slightest difficulty at the proper distance. He must be accustomed to read with the book propped well up in front of him, so that he may not need to stoop over it. He must be taught to write sitting square to the desk and upright, not twisted to one side and bending over it. These things must be attended to at home as well as at school.”

If the pupil is allowed to place the copy book on which he is writing a few inches to the right of the medium plane of his body, the head is turned to the right, the left shoulder is raised, while the right sinks, and the spine is bent to the left. The body becomes fatigued with this strain and the right eye is brought nearer to the paper than the left; this helps to develop unequal sight in the two eyes, and short sight, which may be avoided by a good position. For this reason the written lines should not be too long; while

¹ “Eyesight and How We Lose It.” Hamilton, Adams & Co., London.

to carry into effect a good position in writing the "vertical script" has been introduced.¹

The objects to be gained by physical training are admirably described by Dr. Edward H. Hartwell;² he says: "Speaking broadly, the muscular and nervous tissues, well termed the 'master tissues,' constitute the executive or working mechanism of the body; and the chief function of all the other tissues of the body is to serve either as their purveyors or scavengers. The structural integrity and functional power of the purveyor and scavenger tissues are indirectly promoted by muscular activity; but the most important effects of muscular exercise are, (1) the attainment or maintenance of normal size and strength by the master tissues, and, (2) the acquirement of correct and economical habits of neuro-muscular action. The ends of physical training, then, are hygienic on the one hand, and educational on the other. No comprehensive system of physical training can be considered safe or rational in which these ends are not clearly recognised and intelligently provided for—through the adaption of its exercises to the varied and varying wants and requirements of the individuals to be trained, in respect to their sex, age, strength, mental capacity, and calling in life. The results which should be secured by such a system are briefly these: erect and graceful carriage of the head

¹ See Dr. Burnham, *op. cit.*

² *Boston Medical and Surgical Journal*, December, 1891.

and trunk; a broad and capacious chest in which the heart and the lungs, developed to their normal size and strength, shall have free, full, and regular play; square shoulders; a straight back; fully developed and well-rounded limbs, and the power to execute with ease, precision, and economy exercises of strength, speed, and skill in ordinary gymnastic and athletic feats."

Physical exercises designed to train brain action and evolve its mental powers I have sufficiently dealt with in other chapters (Chapter VII., p. 145).

The desideratum of physical culture for girls and boys is to attain the highest degree of healthy growth and development of brain and body that may be possible during the period of school life.

It is impossible to carry out such an ideal without attention to diet and the proper arrangement of meals. The dietary needed will be much the same in the school and in the family; school meals form a not unimportant part of the duties and responsibilities of the management, and of the members of the teaching staff. The dining hall and the luncheon room afford opportunities for social and moral training, as apart from the schoolroom and playground. Initial ideas of thrift, self-help, and kindness to a neighbour find play in following the rule "Waste nothing," either by broken pieces or by eating too much and picking out the best. Never let the stronger child pick and choose at meals; it is well that sufficient supervision should be kept over

manners at table to assure that the food is eaten by each child, and neither shirked nor wasted, while sufficient quantity is supplied to those who need it the most. In some schools lunch is provided, and the children go home to dinner after morning work; this is usually the case in the English high schools for girls. When the luncheon room is a buffet, and each pupil can buy what she likes for her money, the girl may select "bun and lemonade" or fruit only; most need at least bread and butter with milk. The meal is not a luxury, but a necessity for brain growth, especially for such as do not eat good breakfasts. It would be better for the parents to arrange what the child shall have as adapted to the home meals. Let there be provided: "two sandwiches and milk," "bread and butter with milk or cup of chocolate," "bread and stewed fruit," "biscuits with milk, or gingerbread." When work goes on from 9.30 A.M. to 1 P.M., the brain cannot profit by the stimulus and the training it receives if the supply of food to the stomach has not been replenished since the previous day. "Ex nihilo nihil fit." It is like growing a plant in poor soil; it becomes thin and weedy from the want of assimilated material. The brain is a structure made up of nerve cells and nerve fibres which cannot retain impressions and perform work without food for their nutrition. Some children must be taught that it is their duty to eat that they may live and work.

At meals the food should be varied, sufficient in quantity, good of its kind, and distributed according to the needs, not simply the inclinations, of each individual; when meals are monotonous, children will leave their food even if hungry. The food should be properly selected, well cooked, and efficiently served.

The meals should be planned; if breakfast is at 8 A.M., the last substantial meal having been made at 1.30 P.M. the previous day, the supply of nourishment in the body is exhausted; every child should begin the day with a good breakfast. In girls' high schools most of the work is done between 9.30 and 1 o'clock; breakfast is a necessary preparation for such an amount of work. If lessons are prepared before breakfast, at least bread and butter and a cup of hot coffee should be provided on rising.

Dr. Clement Dukes¹ gives the following as suitable breakfast dietary:—

Sunday. Sausages, broiled ham and eggs.

Monday. Dried fish, steak.

Tuesday. Porridge, eggs buttered.

Wednesday. Pressed beef, brawn.

Thursday. Porridge, dried fish.

Friday. Cold ham, bacon.

Saturday. Porridge, fresh fish.

Bread and butter with milk should be unstinted; coffee with half milk may be substituted for older children.

¹ "The Essential of School Diet." Perceval and Co., London, 1891.

Sugar or salt at choice should be supplied with the porridge. Dinner, whether taken at home or at school, should always be the best meal of the day — well cooked, carefully served, and punctual; each item is important to promote good digestion.

I quote from Dr. Dukes's "Dinner Dietary," which he gives at length:—

Sunday. White soup, cold roast beef, potatoes, salads, pickles or beet-root, fresh fruit, pies, whatever is in season.

Monday. Roast shoulder of mutton, onion sauce, potatoes, mould of cornflour with jam, cheese.

Tuesday. Clear soup with vegetables, roast fillet of veal, or boiled leg of mutton, potatoes, greens, plum pudding and sweet sauce.

Wednesday. Roast sirloin of beef or curried rabbits, potatoes, cauliflowers, batter pudding, cheese.

Thursday. Mutton broth with rice and vegetables, quarter of lamb, potatoes, peas, baked apple puddings.

Friday. Roast loin of pork or boiled salt beef, potatoes, carrots, turnips, onions, cabinet pudding or baked rice, cheese.

Saturday. Pea soup, roast leg of mutton or Irish stew, potatoes, parsnips, boiled marmalade puddings.

A variety is here given; the details should be changed each week.

For the older children at least, who work in the morning and afternoon, with some preparation of lessons in the evening, a substantial tea at 6 P.M. is necessary. Bread in plenty, with jam, marmalade, honey, treacle, and watercress. Milk can be given, or,

if preferred, cocoa. Tea and coffee should not be commenced early, and in any case much milk should be taken. Girls and boys who are delicate, or bad eaters, and those growing fast, may require in addition, egg, fish, or cutlet. After evening work, bread and butter or biscuits with milk, or milk pudding, may be taken if desired. The child should not go to bed hungry. I have spoken somewhat fully of dietaries because in my experience many children — whether living at home with their parents who are both able and desirous to do the best for them, or those at boarding school — often take insufficient food for their healthy growth and brain activity. Children vary much in appetite, and the same boy or girl at different periods of life may change; while some are so foolish as to refrain from eating because they fear to grow fat.

With some families food is insufficient from lack of means; still, cheap food is not always economical, and selected good food may be inexpensive. Bread made of brown flower goes farther in nutrition than white bread. No pieces should be wasted. Good margarine or dripping may well replace butter. Bread should be unstinted; the crust is twenty-five per cent more nourishing than the crumb; bread should never be used till the second day. Milk costs money, but it is very necessary for children; it should be carefully protected from dust and dirt, being received in a re-

cently scalded jug and covered with a sheet of clean paper to keep out dust, which so soon spoils it.

Fat food is necessary; it may be provided in the form of bacon, butter, dripping, margarine, or as suet pudding with treacle or sugar. Sugar taken with food, not as sweets, is a useful heat former, and aids brain nutrition. Porridge for breakfast, taken with sugar or salt, is wholesome and nourishing; the oatmeal should be put to soak over night so as to be softened by the morning; then twenty minutes' boiling is sufficient for thorough cooking. Cheese taken at dinner in small quantities is to be recommended.

In every boarding school, and with advantage in the day school also, a matron should superintend the diets and be present at meals to see to the proper distribution of the food. It is an advantage that a superintendent who knows the children, and any with ailments or indispositions, should see that they get and take their necessary food. The matron knows the child with constant catarrh, and takes care both that in the cloak room the stockings are changed when damp, and in the dining room that the fat of the meat is eaten.

With students who have the advantage of college life after the years spent at school, the continued care of health becomes a personal duty which should not be neglected in any of the items that have been indicated. Young men and women whose occupations are largely sedentary should be enabled and encouraged to take

exercise out of doors for at least two hours every day. Daily and regular recreation of mind with active bodily exercise is necessary to assure that degree of continued physical health without which a career of useful, social employment after college life and graduation cannot reasonably be expected. All the powers of the body and the brain need exercise to keep up perfect health and its probable maintenance in future years.

It must be remembered that those who have been healthy and strong during school years may manifest the tendency of their inheritance, for good or bad, during the years spent at college, and the reasonable care of health is a duty resting on every student. Some inherit a tendency to gout, asthma, recurrent headaches, dyspepsia, and consumption, all of which are apt to develop after adolescence; wilful disregard of personal health while engaged in study is a reckless disregard of the future.

Perhaps advice as to the need of exercise is more necessary for women students than for men; when the conditions of living are unhygienic the power of resistance and capacity for recovering health is usually less in women than in men. (See Chapter XIII., "The Study of Children.") It is not enough to sit out of doors with a book; active exercise should be taken in lawn tennis, walking, cycling, or on horseback.

There can be no doubt as to the advantages that have resulted from providing higher educational ad-

vantages for women; their successes at college and the universities seem to be established. There are, however, other aspects of the case, which, although they may concern a minority, are still very important to individuals. If a student's life is desirable for some women, there are others who not only fail to derive benefit therefrom, but receive harm from the necessary strains incurred; there is apparently more difficulty in recovering from injured health among women than men. The following health statistics of women at college were collected by Mrs. Henry Sidgwick:¹—

	At ages 3-8 years.		At ages 8-14 years.		At ages 14-18 years.	
	American.	English.	American.	English.	American.	English.
Per cent in excellent or good health . .	76.74	71.45	73.33	67.09	..	61.97
Per cent in fair health	1.84	16.98	2.98	22.78	..	27.14
Per cent in poor or indifferent health.	21.42	11.57	23.69	10.13	..	10.89
	100.00	100.00	100.00	100.00	..	100.00

Anæmia with neurosis, the outcome of neglect of health-care, is apt to become confirmed as a form of nervous dyspepsia such as has incapacitated many women, otherwise intellectually fitted, for a useful business or professional life.

¹ "Health Statistics of Women Students of Cambridge and Oxford," 1890. University Press, England. Also quoted in Report of Commissioner of Education, Washington, 1891-1892, Vol. II.

AVERAGE AGE AT ENTERING COLLEGE LIFE

	American 18.35 years. English 21.9 years.	
	American.	English.
Per cent in excellent or good health	78.16	68.20
Per cent in fair health	1.98	22.08
Per cent in poor or indifferent health	19.86	9.72
	100.00	100.00

I cannot draw any definite conclusions from these statistics; the proportion of English students returned as of fair or indifferent health is much higher than according to my own observations of one hundred thousand children seen in English schools, mostly of the poorer social class.¹

Breakdown of the brain power and mental disabilities in college life and during the early years of the business life of young men, and of women in their domestic cares or occupations, not uncommonly result from want of previous training to bear hard work and mental strains. It therefore appears useful in the study of education to trace the physical causes of mental abilities and disabilities, which should be followed out in all their details as a basis of mental hygiene.

¹ See "Report on the Scientific Study of the Mental and Physical Conditions of Childhood," based on one hundred thousand children observed individually in schools, by the author. The Macmillan Company.

CHAPTER VII

THE TRAINING AND TEACHING OF YOUNG CHILDREN

I DRAW some distinction between training and teaching, using these terms for methods, not totally distinct and separate, but rather separated as having different objects in view. Training is intended to get the brain ready or prepared to benefit by the methods of instruction and learning. The child must be trained to speak before there is much value in what he says; he should be trained to see colours before you teach the colours of flowers, and the natural history of their varieties. The child should be familiar with numbers before employing symbols to represent them in arithmetic. You should train the child to move his eyes up and down regularly, as in looking at points or lines on the black-board, before expecting him to add a column of figures, or set down a sum on the slate. It is necessary the child should understand that looking up the map is towards the north, and turning his eyes to the right of the map is looking east.

One difference between training and teaching is that in many ways the child may be trained by impressions received without the use of words, and before these are understood. Training the brain may precede teaching

with the young child ; the nerve system may be brought under some control before any attempt is made to implant definite knowledge.

It is doubtful whether some of the words early acquired correspond in the child's mind with any fixed ideas or thoughts : for instance, he may say as words — thing, gas, time, wood, soft, ten, good, as words without meaning. Names may, however, be associated early with things seen, and a little later with actions. Thus, mother, dinner, sugar, bath, as terms, represent something to the child ; so do going to bed, walking, sitting still, etc.

In training we produce many sensory impressions, and subsequently connect them with names.

The child is shown a book and made to look at it ; then you teach the word "book" as he looks at you, afterwards making him say the name as he looks at the volume. He sees the object, learns the name, then the sight and the sound become associated in his head ; thus you proceed stage by stage in early training so as to be sure that each impression wanted is formed in his brain. He will subsequently see many books differing in size and in the colour of the covers, but he can connect the common name "book" with each of them. Throughout your training spontaneity of action should be encouraged, while cultivating action through the senses and by muscle sense, so as to bring his brain under control.

Training in any physical action produces temporary control of the nerve centres, and exercises the healthy brain in the quick formation of impressions through the senses; much may be done early in brain training by exercises in following a moving object with the eyes, and in imitating movements made with the hands and the fingers. In such exercises, if repeated at intervals, the brain centres that have been thus frequently caused to act in harmony become connected by new nerve paths; every fresh nerve path formed adds to the development of brain power. When the child rests, those nerve cells that were caused to act in unison may again act separately and spontaneously; still they remain more controllable either for repetition of the former exercise or for further action; while under training the brain centres grow more apt for mental expression and accurate control through the senses. In the primeval forest it is impossible to move freely from place to place; but as paths are cleared it becomes more and more possible to move between different points, and as these paths are worn smooth by use it becomes easy to travel in any direction they may take.

The inborn faculty of imitation is the physiological character of the brain of which you will first take advantage in training.

I do not think that imitation of your movements tends to raise any particular thought in the young child; this has advantages. Training can begin before

thoughts occur or are implanted; some children think too much and yet need training. These exercises train coördinated brain action and cultivate capacity for connected thinking, but they do not appear to stimulate thoughts.¹

Hand exercises are useful means of training the child's brain, causing his nerve centres to act in the same manner as those of his teacher; good modes of action, accurate and orderly (coördinated), may thus be cultivated. Let the pupil stand in front of you; try to get him to look at your hand as you hold it out, and then accurately respond to each movement your fingers make. Your movements should be slow and carefully made, so that they may be distinctly seen by the child and exactly repeated, corresponding in action both as to the fingers moved and as to the direction and quickness of each act performed. Careful observation and attention is required here, just as in learning anything else; this teaching should be precise and accurate, not merely a suggestion of action. The pupil must not look at your face, but watch your hand and fingers; do not talk, then, but train him to respond to your movements through using his eyes only, and get what you want done in silence; if you talk he will look at your face. If you cannot get the child to fix his eyes on your hand as he stands in front of you, provide a looking-glass in which the pupil can see your

¹ Reference 54, on training children mentally feeble.

right hand while you stand on his left side, so that your face is not reflected in the mirror. Begin by holding out a straight balanced hand with the fingers separated; see that each finger is straight and the thumb not drooped. This will require practice, for it corresponds to an attitude of attention. The pupil should then produce this posture exactly and move his fingers as you do, dropping his hand when you drop yours. Now for some more advanced exercises: I will name the digits thus — A, the thumb; B, the index finger; C, the middle finger; D, the ring finger; E, the little finger.

Make the following movements with your hand, separately, slowly one after another, at equal intervals of time, so that the pupil can see them individually and reproduce each movement himself, bending or moving each finger respectively to the same degree as yours:—

EXERCISE I. A, bend thumb; A and B; A, B, and C; B, C, D, E.

EXERCISE II. Bend A, B, C, D, E, together; A, E; E only.

EXERCISE III. B, index finger, moved from side to side without bending it up or down.

EXERCISE IV. A, bend thumb; B, moved from side to side; C, bend and straighten; E, little finger, moved from side to side.

These exercises can be enlarged upon and varied to any extent. It is well after each exercise to let the

arm drop and the nerve centres rest; before commencing another exercise bring the hand up to the straight balance.¹

Movements and the corresponding nerve centres are thus temporarily coördinated by sight only; sight of your hand controls the brain action, and this is indicated by action in the child's hand. This kind of training will be useful in preparing the pupil to learn numbers, after the numerals have been acquired as words. After practice in such coördinated movements the series may be made more complex and both hands employed, either together or alternately, or with the feet and legs. Exercises several times repeated become retained in the brain or learned, so that they are repeated without any further guidance from the teacher and simply on the direction to make such an exercise as you name; this is much like learning a scale in music. This established mode of (compound) brain action indicates the formation of nerve paths connecting the nerve centres whose action you coördinated through sight.

I have several times referred to the importance of eye-movements (see Chapters III., p. 58; IX., pp. 180, 185); they need to be cultivated in brain training that their nerve centres may become controllable both by sight and by sound. Make the child move his eyes by fixing his sight on a small object held in your hand or fastened

¹ Reference 37. Evidence as to physical training.

at the end of a pointer; let him follow it with his eyes without moving his head. Children move their eyes readily in following the light reflected from a hand mirror as it passes over the walls and the ceiling. In ball play, the eyes move in following the object; cricket cultivates rapid eye-movements, and practice makes an apt cricketer. Remember also what was said as to the advantages of cultivating distant vision. (See Chapter III., p. 66.)

Movements of both the hands and the eyes, after they have been acquired as described, may be controlled through the ear. The child will point or turn his eyes as told, to the right or to the left, up or down, but before this you must use words and teaching through the ear. Hand and eye movements, when well under control, are useful for producing the brain impressions needed in teaching such varied subjects as numbers and arithmetic, estimation of dimensions, area and volume, height and distance, as well as geography. (See Chapters I., p. 9; IX., p. 180.) If the pupil's eyes move from one object to another, he receives impressions from his eye-movements (muscle sense) as well as by sight, or if his hand points to them in succession his muscles impress each movement.

When teaching the child to copy a drawing, say of a house, you control his finger movements by sight; he must look at the length of the line representing the height of the house before he draws it, and move his

eyes up and down in making the line with his pencil. Such movements he may practise from you before using the pencil ; thus he learns to imitate your action, then copies the drawing. In such instruction you will aim at getting some control over the child's brain, neither checking all his spontaneous movements nor expecting accuracy at first. When the boy measures the top and the sides of a card at sight he does so by movement of his eyes from one corner to the other, and receives a different degree of impression in each case by muscle sense. "Vertical," "horizontal," and "sloping" are terms or words (sounds) that we connect with direction, and must be coupled in the child's brain with impressions of eye-movements ; so also the points of the compass as seen on the map. Later on we shall see that much is learned by the degree or amount of muscle movements as well as their number, and that many impressions are thus received on the brain which are employed in teaching comparison and proportion. To get the eye and hand movements well under your control, and the impressions thus received by the brain retained in their order, does much to cultivate mental aptitude and prepare the way for further instruction. Such teaching does not require much use of words ; you will proceed stage by stage in your work ; each acquirement prepares the brain for training under guidance in the future.

Such training as I have described—though it be

called physical—is adapted to produce brain impressions very analogous to mental action, while the employment of words is hardly necessary.

Muscle sense is an important source of brain impressions that I must dwell upon; particularly as the usefulness of this sense does not appear to have attracted sufficient attention hitherto in educational methods. (See Chapter II., p. 37.) The muscles produce all the movements you see; every movement results from the action of a nerve-muscular apparatus, whether it be gesture, speech, or writing. The nerve centre stimulates the muscle to contract; the muscle then sends up an impression to the brain; this stimulus results either from the muscle contracting and shortening (producing movement), or from its tension and being pulled upon (as by a weight in the hand). With your eyes shut you know when you move your hand, you can touch your eye or nose, you can count your movements, say in what direction your hand moves, and whether quickly or slowly. Further, if you press a finger on the table, you know whether you are pressing lightly or hard; if weights are placed in your hands you can tell which is the heavier. In the kind of exercises described you do much to train the brain through the employment of muscle sense in movement; you may exercise muscle sense in tension by use of weights placed in the hands. In this mode of physical training you will have the means of acting

on the child's brain, whether he has mental faculty or not; the power to deal with him and produce impressions is in your hands, you can *make* him do some things and feel some impressions. This concerns your work with a very young child or a pupil lacking in mental ability.¹ If you cannot at first teach him names, reading, and writing, you have here a form of training that can be employed. If the child is very dull he may be unable at first to reproduce your movements with the same accuracy as another child; still you can train his muscle sense, and as this improves, the brain centres become more fully organised by the practice, while new nerve paths are formed among them, so that your patient, persistent, intelligent efforts lead to good results, and the dull children may be greatly brightened.

This training in movements may be called "physical" training, but as shown, it is adapted to produce brain impressions very analogous to mental action, though the employment of words is not necessary. It is, however, very fatiguing and cannot be long continued like drill; on this ground, and for other reasons, it seems to me that such physical brain training should be conducted by the class teacher in very short lessons, say of five minutes at most, while drilling is perhaps left to a special teacher devoted to the work. The object of the kind of brain training I urge is to give

¹ Deficient children. See References 17, 20, 21, 22, and 44.

capacity for future instruction ; the class teacher should then be familiar with this as well as the other subjects to be taught hereafter, and include all the training that is wanted for the next stage of class teaching. Further, the conduct of training in imitation of action accustoms the pupils to their teacher, and is likely to lead to harmonious understanding of one another. Where the subjects of class instruction are reading, writing, arithmetic up to addition, with the use of maps, the pupils need previous brain training in looking at and seeing, in finger movements, and in appreciation of numbers, etc.

The mistress of a school had learned something about the observation of nerve signs in children, and their association with brain conditions causing mental dullness ; this she explained to the other teachers of the staff. The children in a very dull class were then observed, and it was found that nearly all showed some subnormal nerve signs (see Chapter III.) ; the pupils in a bright class were also observed, and very few were here found with any defects in movement or in expression. The teachers determined to endeavour by their training to improve the hand balance, finger action, and eye-movements of the dull children. Their efforts resulted in this : three months later most of the dullards had been so much brightened in their general brain power that they were removed to the upper class.¹

¹ Reference 54.

Preparatory training does not necessarily produce immediate results in mental power; it has, however, been shown by experience that the well-trained child acquires knowledge more easily and accurately after a period of preliminary training.

Dr. Hartwell speaks of exercises of "the coarse adjustments of the body," in contrast with quickness and accuracy of eye and hand movements; it is on the latter I have mainly dwelt as a means of training intellectual capacity. Dr. Hartwell says:¹ "In general, we may say, that the Grecian gymnastics and athletics, and the martial exercises of the ancient and mediæval Gauls and Teutons, were of a character to affect chiefly the fundamental or earliest developed neuro-muscular mechanisms which constitute the coarse adjustment of the body. The more massive bodily virtues of strength, endurance, and speed are promoted by popular sports; whereas dexterity, address, sleight-of-hand, quickness and accuracy of eye and hand, require more specialised and complicated forms of exercise for their development. In other words, British sports are insufficient for the purpose of giving a complete training to the fundamental and accessory groups of muscles, and require to be supplemented by such drill as is afforded by the systematic gymnastics of the Swedes and Germans. For purely educational ends no system of physical training

¹ Dr. Hartwell, *op. cit.*, 1892.

has yet been devised which is equal to the Swedish school gymnastics. American physical training will remain a thing of shreds and patches, unless the promoters and governors of our educational institutions shall set themselves to learn and to apply the teaching of science and experience with regard to the nature, scope, and results of physical education."

To what are here described as British sports and Swedish gymnastics, which exercise the body and the muscles, I have added and here present for your use exercises in movements and through the senses which afford brain training adapted to evolve the child's mental powers and healthiness.

It is necessary to train the brain centres for the purpose of rendering them apt for mental processes. Accurate impressions are essential; these must be often repeated, in order that they may be exactly retained in the brain; this is true both for a set of movements and in learning to pronounce words. The exactness of the impressions made on the brain is a physiological matter; it is much under the control of the teacher, whose method is to produce impressions one at a time, by sight, then through the ear, and others by feeling (muscle sense). The understanding of the impressions received is something occurring in the pupil's brain; it is an interaction among the nerve centres which we should not attempt to produce till we know by response in the child—or other reason-

able evidence—that the primary impressions have been received and retained.

Neither movements in physical training, nor the words the child is taught to pronounce, have a meaning connected with them in his mind at first. Exactness and retentiveness of impressions by sight, sound, and feeling must be produced first, then these may be coupled in repetition; thus in brain action the nerve centres become connected by the formation of nerve paths among them; “understanding” comes later, and probably corresponds to some gently spreading area of the brain in action, so that this should not be attempted till the primary impressions themselves are retained and accurate. (See Chapter VIII., p. 164.)

Red, white, blue, may be produced as primary sight impressions; “red,” “white,” “blue,” may then be pronounced as words; in repetition each colour and name may be coupled by association, a sight impression with each term. At another lesson each sight impression may be coupled with the term “colour,”—red “colour,” white “colour,” blue “colour.” Then “colour seen” may be abstracted from the teaching, and applied to the discrimination and description of coloured objects,—red, white, and blue flowers. This is why I prefer teaching colour with pieces of paper, etc., not coloured objects of special form, so that the colour seen may form the impression alone, and on other occasions may be abstracted from among many

impressions received by sight. Children are often confused in expressing their early impressions, they will name sounds as light or dark, or objects as large or heavy, indiscriminately; the pupil cannot classify his sensory impressions till he has received and retained many results of his training, coupled with names for expression.

Discrimination and choice indicate interaction among the nerve centres of the child's brain, and form an elementary mode of mental action worth training. A very young child without the use of words may make choice between objects and colours seen, or respond more readily to certain sounds. He may select from objects before him a bright sovereign in preference to a dull farthing, even if after taking it up he only puts it in his mouth. Such discrimination and choice is a very rudimentary preparation for making comparisons, and precedes the faculty for judging of similarity or difference among sensory impressions. The discrimination and retention of sensory impressions under guidance lead to experience which forms an intelligent basis of choice; when two objects are seen, two sight impressions are produced in the brain, and the stronger is expressed in action. Training in making a choice is an early method of cultivating the child's character in ability to make up his mind at once. A young child when asked, "Shall I read to you?" just says "yes" or "no," or cannot decide. In an older

child experience helps him to decide; former impressions arise in connection with reading; it means keeping quiet and not going out to play. Training in making a choice is an aid to cultivating voluntary power, after some experience has been acquired under guidance. (See Chapter X., p. 205.)

In brain training a fixed set of impressions united to act in a certain order is often required; each should be accurate, and the whole series well retained, ready for reactivity. This may be cultivated in repeated physical exercises, or by words first taught separately, then repeated in a certain order. Thus, the letters of the alphabet separately, then in their order; or, more usefully, the elementary sounds may be taught. The use of numerals is so necessary in teaching that I think they should be taught early as an order of words; among older children verses may be learned.

A fixed set of impressions in the brain of the child is needed when you try to cultivate the faculty of comparison, and the expression of addition or proportion. In training the child, a mental standard of weight may be established by placing one ounce, two, three, and so on up to ten ounces in his hand in succession, thus producing proportional strains on the muscles,—as described in Chapter II.,—and impressions of corresponding degree in his brain will be retained after practice. (See Chapter X., p. 199, on Voluntary Power.) The feeling of each weight may then be

associated with the numerals; thus he learns to appreciate and express an ounce, two ounces, etc. The pupil learns weights as he learns other things, by impression through the senses; he learns colour by sight, numbers by movement of his hands and eyes, weight and proportional weights by the sense of the muscle strain. In such a lesson it is useful to teach that you are "weighing"; by and by, after experience, the abstract idea of weight and pressure will be understood by the child. Weight, as apart from dimensions, is impressed by using iron weights in which size and weight are directly proportional, in contrast with empty or weighted pill boxes. I think weighing in the hands gives better early training than the use of scales.

Measurement of length can be taught by movements of the head and the eyes. Give the child sticks — one inch, two, five inches long; make him look at each in turn from end to end, then feel the length with his fingers; each length may afterwards be expressed by a number. Such training by employing muscle sense is useful in teaching dimensions, area, volume, and proportion; sensory impressions are here produced by muscular movements, not by muscle strain (see Chapter II., p. 37); this is less easy to control, hence I think the use of weights the best means for early training in comparison.

In training the brain you thus proceed to teach the

names of the numerals, and repeat them in order; then establish a mental standard of weight, and a standard of measurement, employing the numerals for expression. All this helps to produce fixed and accurate impressions on the brain, which will be employed in their revived activity when teaching comparison and proportion, as well as the use of symbols, which facilitate calculations as much as words aid connected thinking and expression.

Training must proceed stage by stage. The pupil can feel the greater strain of four ounces in his hand after the two ounce weight, and learn to express this as "the greater weight" before he names the weights; it is but little good for him to name the weight before he has felt it. Again, the pupil can say which stick looks and feels longer, before he can estimate the length and express it, which needs more practice.

Elementary training in mental processes a little more advanced may be used in comparison as to "agreement or difference," in any such lesson impressions previously made in the brain are compared under guidance. The teacher should carefully consider some one point for comparison, it may be weight, length, size, or colour. Each of these characters should have been taught previously by many examples where the sensory impression has been associated in the teaching with terms of description; it is thus our business to trace out and study the impressions produced in

good training, and not to be satisfied with a connected train of ideas in our own minds which are to be implanted in the child's brain by the use of words only.

Thus: objects such as flowers may be compared as to colour; this must follow teaching of the colours and their names; it is also necessary that the child should know that the term "colour" includes red, white, and blue. From among many coloured flowers the pupil is guided to select those of the same colour. Weights felt are alike or unlike; the sticks felt and seen are of the same length or different; the feeling of two series of movements made with the hand are alike, or one series is greater and more frequent than the other.

A further stage is to discriminate size from weight, as by the use of weighted pill boxes; to aid abstraction and appreciation of the characters compared, lessons in number, weight, length, and colour should at first be short—say ten minutes. This kind of training by sensory impressions is necessary before we have any right to expect the pupil to understand the teaching of equal quantities, addition, proportion as taught by the use of figures, or description of form and shape.

CHAPTER VIII

ADVANCING SCHOOL METHOD AND TEACHING

THE child on entering school is placed under a new set of circumstances adapted both for teaching and training. One very important element in school life is that children tend to imitate one another and do as others do, each boy looks at the others as well as at his teacher, for children are mostly gregarious and social in their habits. The children show spontaneity; you want to cultivate attention and mental aptitude for instruction; if the child be already trained to sit tolerably still, while his movements of hands and eyes are controllable, you proceed to produce new brain impressions and couple them with names, accompanied by your directions which guide him. Show a piece of red paper, make him look at it, and then look at you as you pronounce the word "red" while he repeats the word in imitation. He gains a new impression, that of the word, then sight of the paper and sound of the word are coupled in his brain by seeing and hearing at the same time.

Make him hold out his hand and move the fingers A, B, C, D, E, one at a time in succession, and again all together; then, dropping his hand, look at you while

you say and he pronounces the word "five."¹ Make him turn his eyes to five similar objects at equal distances apart, then look at you and say "five"; thus in each case you make five impressions by muscle sense and teach the numeral. Put an ounce weight in his hand, add others up to five ounces, and make him say "five"; he feels by his muscles the strain added by each weight, and feels the "five" heavier than the one.

The impressions made have to be associated with terms of expression such as describe what is seen, felt, or heard; the names of things and of actions as well as of mental processes must be learnt; for instance, "book," "colour," "weight," "addition," etc., and these must be clearly and separately appreciated by the pupil.

You may find it best with most children to let them get a number of different kinds of impressions at the same time, as when the child sees, feels, handles an object while you name it; he will then at some subsequent period have to separate and classify these different impressions when learning to make comparisons.

You may think it convenient first to demonstrate what you have to show without full explanation, and describe it afterwards fully. Sometimes, as with advanced pupils, you may prefer to describe what you have to teach, and the general principles to be illustrated, and demonstrate your facts or experiments

¹ See "Notation of Finger Exercises," p. 105.

afterwards.¹ I have found this the better plan for gaining the attention of a class in chemistry.

With a difficult child, however, I have found it necessary to produce impressions one at a time, or singly, as explained in Chapter VII., p. 153.

You cannot teach much about length till the pupil can use numbers; you cannot usefully teach him to measure lengths in inches till he knows the inch as a standard of measurement. I think you will find he can compare lengths before he can express them in words, and that is a true mental act. Take a plain card 1×2 and pin it to the blackboard to be looked at; as you point direct the pupil to look along the top, see that his eyes move, then let him look away and again receive a fresh impression of the side of the card looking from the top corner downward. The child will soon appreciate the different amount or degree of his impressions in the two eye-movements; later on, when he has acquired a standard of measurement, he will be able to make comparison and express the ratio. Thus the child becomes ready to learn how to describe the form of the card by its proportion, and to recognise its shape as oblong.

This kind of analysis as to the brain action in a pupil shows us that in early training sensory impressions must precede teaching; thus:—

¹ See Catalogue of Examples in Natural History, "Mental Faculty," pp. 166-212.

1. Names of the numerals in their fixed order, as heard (auditory impressions).
2. Numbers in their order of degree as felt in movements, and numbers of weights (felt by muscle sense).
3. Standard of measurements, associated with terms for expression.
4. Standard of weights and the terms of expression.
5. He must be taught by practice to associate mentally the terms describing measurement and weight with the impressions he has previously felt and retained; as one inch, two ounces, four ounces, the latter being greater.
6. The pupil must also be taught the terms of direction as used in teaching connected with the mental processes required of him. He must understand what is meant by counting, adding, comparing.

In a simple act of comparison of the length of two lines at sight, the brain processes appear to be as follows:—

1. Acts of observation, turning the eyes and seeing, produce sensory impressions by sight and by muscle sense.
2. Under your direction to compare the measurements there arise in the pupil's brain: (*a*) the standard of measure, and (*b*) the numerals as to means of expression.
3. A judgment is formed and expressed; this is a

mental act; it differs from the impressions received, and is due to interaction among brain centres.

4. We see plainly, then, that the direction given is necessary to the formation of this act of judgment.

It is our business to trace out and study the impressions produced in good coördinated teaching.

Impressions on the brain can be made without the use of words; but the words employed in giving directions must be carefully taught. With weights in either hand the child does feel the strain of each; the degree of each impression is not the same. He can be taught to express comparison in terms of "greater," "less"; so with comparison and expression of lengths. Here he compares real impressions received, and so learns to understand comparison of quantity when using figures in arithmetic. Length felt by finger movement produces an impression on the brain; such lengths may be equal, or one may be longer. It is often very interesting to study the methods of teaching a very dull pupil. A child mentally deficient or backward is often so slow in all mental processes that it is easier to follow these in detail than in a brighter and quicker child; the methods of his intelligence may be almost infantile, and like those of a child only just learning to speak; but if the dull boy has speech we may follow out the slow working of his mind more readily than in the little child. I took a boy, mentally defective, who

had been trained as I have explained, and showed him a horseshoe; he looked at it well. Without speaking I guided his finger, moving it slowly and uniformly from end to end outside the curve, then let his arm hang limp by his side. Again, I guided his finger from end to end inside, and then let his arm hang down. When asked, "What can you say?" he replied, "It is rough." "What else?" He said nothing. Desiring to abstract in his brain the feeling of the surface from the length of movement, I said, "Do as I do," moving my finger in the air slowly, as when following the convexity of the horseshoe, and again, after an instant, moved as when tracing the inside of the shoe. "What can you say?" He replied, "Round." "What length?" A smile spread in his face, and he replied, "Longer outside than in; it is bent." Asked, "If I straighten it out as a straight bar, how long will it be top and bottom?" at the same time moving my finger as if along the top and bottom of a bar. He replied, "Same top and bottom;" but the pause during thought was long, and his features worked the while.

The appreciation of time needs to be taught by impressions received. The same boy had just learnt to read the time from the clock; he knew the sight and names of the figures on the clock face, and could tell the time exactly. He knew that there are twenty-four hours in the day, and sixty minutes in an hour. He could not tell me how long lessons lasted in the morn-

ing, but said, "Ten to twelve;" after being directed to count, he said, "Two hours."

Asked, "How long are you at dinner?" he said, "I don't know." Wishing to produce some impressions of time in action, I made him move his head, then his hand, in following my movements, first slowly but uniformly, then more rapidly; expression was then easily elicited, "That is quick movement." After such exercises in appreciating time he told me that he was in school two hours in the morning, and after a pause added, and half an hour at dinner, showing that he understood what was asked for. I think that boy could be taught impressions of time as well as the clock, and suggested to make him run half a minute, one minute, then ten minutes, etc.

The child of school age should know all the objects in the room and be able to name them; it is also necessary as school work becomes a more serious matter that definite ideas should be conveyed by what is said, as well as lines of conduct, such as: kindness, obedience, justice, punctuality, as abstract terms understood and associated with modes of action.

At seven years of age a trained child should already be possessed of a vocabulary available for expressing thought and mental action, and for giving descriptions and replies to questions. The acquisition of words is further necessary that he may become amenable to guidance and the words of direction and teaching employed. Language is one of the greatest possessions

of man; training the child in the proper use of words effects much by imparting thoughts to the mind.

I think ideas of causation may be taught early. In training observation, the pupil must be practised in noting the order of events in time; you can teach what happens and what follows without giving explanations. The sunlight comes upon the garden in the morning, then the flowers open; the light reaches the plant near the window, next day the stem is bent towards the light; the bee visits the flower, then gets the honey. These events can be shown or taught without explanations, which cannot be understood by young children; but they should not be taught in school that the flowers open to meet the sun, that the plant bends towards the light because it needs it, or that the bee knows he can get honey from the flower. Sunlight reaches the flowers before they open; unequal growth in the two sides of the stem, resulting from the action of light, is the mechanism which produces the bending; while it has been shown that the colour of the flowers controls the flight of the bee.¹

It is important in teaching to train the pupils to separate their observations or brain impressions, as we know this process is necessary to classification and comparison. If a number of objects are seen and

¹ For examples, see "Anatomy of Movement," pp. 78 to 84. The Macmillan Company.

felt they may be classed as to weight, measurement, dimensions, and proportion, or as to colour, etc. Length and breadth as two measurements may be compared; but size and weight have no common unit for comparison. For this reason in early training only one class of sensory impressions should be produced at a time as far as possible. At first the pupil must be guided as to what to compare; the points for comparison should be arranged in classes and their proportion studied. In other words, the child must know what to look at and be guided as to what to look for; he is taught to look at the two ends of the bean and measure their distance apart, then to look at the sides and to measure the breadth, then to make comparison of his impressions of length and breadth, which are sensory impressions by feeling, but not each of the same degree; the length is greater.

Throughout your teaching some amount of spontaneous brain activity, both in movement of the body and in thought, should be encouraged and cultivated, as well as controlled. The teaching should be stage by stage. First for the purpose of producing impressions on the brain, then to connect and guide action resulting, it is useful to allow some "question time" for the pupils' spontaneous inquiries. Words must be used in teaching, and as far as possible they should be associated with definite impressions and thoughts. Geography is associated with the earth and the conditions

of its surface all the world over; not only with maps and towns. I have spoken before of teaching from maps; models are also most useful. After teaching the class from the map that London is five hundred miles from Aberdeen, a pupil may ask, "How far is five hundred miles?" Remind him how long it took, and how he felt, after walking to a place five miles away; then tell him to think of walking five hundred miles. Thus thoughts are separated from the sensory impressions that primarily produce them, and being still retained, can be employed and directed by the use of words; distance can be appreciated by employing a fixed standard of distance, and the comparison of numbers.

In the study of history and geography it is necessary, from time to time, to extend the field of thought and the number of known facts under consideration, so that general views may be formed of historical periods, or of the physical and climatic conditions of a country — as well as in studying the causes of events through periods of time. On the other hand, it is often desirable to make a detailed study of a short historical period with a few historical characters; or of some one mountain range or river valley; or some other selected subject for detailed study. In preparation for such mental processes the brain must have many impressions stored up and connected with terms of expression, all retained and ready for reactivity and rearrangement under the guidance of teaching, as re-

lations among them are successively pointed out. The mind should be well stored with observations and facts, which can be studied in many ways.

Training for this kind of mental aptitude in enlarging and limiting the field of thought may be practised when teaching the observation of objects which produce sensory impressions under your guidance and control. When making the child select one object from among many you control his field of observation, and limit his thoughts to that one specimen. It is perhaps more difficult to extend his range of thought sufficiently to include what is not within his sight. The capacity to think of many things at one time, or, on the other hand, to limit thought, is an important mental habit; this is necessary for students of natural history, who must follow numerous examples when collecting the experience required for large conceptions or generalisations. When you demonstrate a growing seedling plant as an object in teaching, the pupil should at first limit his observation to what he sees; looking at the root, the stem, the leaves, and their parts; then he may make comparisons among his observations. After this the pupil must be led to enlarge his subject of thought, and include the water as a part of the food material of the plant, and the light which stimulates and controls the growth of the plant structure.

Again, when you demonstrate that light causes bending of the head of the plant, the pupil must for

the time limit his attention to the stem and observe its two sides, noting that the side towards the light is concave and shorter. Thus he learns that light lessens the growth of the stem on the side that is illuminated. In this way the mechanism of growth, the food supply, the effects of light, all become gradually familiar to the mind of the pupil; further, he is thus trained in his brain action, and in mental habits useful in studying other subjects.¹

Memory or retentiveness of the directions, and the means of guidance given in teaching, form methodical modes of procedure and principles of thought. We do not teach logic to children, but your teaching should be according to the principles of logic, conducted stage by stage. In the study of both science and language the methodical order of procedure in analysis and classification needs to be firmly retained in memory; either subject of study may afford such brain training as gives mental aptitude for the other. Parsing is a useful preparation for the systematic description of natural objects; some form of schedule is useful in teaching natural history, and practice in employing it will prepare the pupil's faculties for the grammatical analysis of verbs, nouns, and adjectives. Modes of guidance, directions, the means of expression, as well as judgments previously formed and re-

¹ Examples. See "Mental Faculty," Catalogue of a Museum of Natural History, pp. 163-212. The Macmillan Company.

tained, may be revived, then rearranged, and thus lead to the acquisition of fresh knowledge; such modes of mental action are called into play in teaching geometry.

The methods of education should be coördinated; the modes of brain action employed in analysing words may be previously exercised in analysing objects; estimation of proportional weights felt in the hands prepares the way for understanding proportion as expressed by lines or figures; the habit of observing each part of an object and then comparing them leads to observing proportion in growth, and clears the way for understanding the effects of light, heat, and gravitation as they respectively affect the growth of plants.

Thus, after early training in cultivation of the general characters of brain action described in Chapter II., mental training in school may proceed to exercise choice and discrimination. The faculty of observation and separation of qualities observed in objects, followed by their analysis and classification, prepares the way for the formation of generalisations which form knowledge of wide application.

Habits of mental analysis may be trained by accuracy in methodical observation; let the pupil begin early to look at one thing at a time, then at its parts, and later at the relations of many things and events to one another. This will exercise some of

the modes of brain action that are employed in the analysis of languages; I have found through an experience of many years, that students well educated in languages are more easily trained than others as observers in science and in medicine.

A schedule may be used for the purpose of directing the pupil when studying natural history.

<i>Sensory impressions.</i> Observation of the still object.					<i>Mental action.</i> Mental comparison of : —					Enlarging field of thought and observation of external agents.			Observing and studying growth and action in the living object.				
Two or more objects.	Individual object.	Measurement of object.	Weight.	Parts of object.	Measurements, <i>i.e.</i> ratios.	Ratios, <i>i.e.</i> proportion.	Measurements with a standard of measure.	Many measurements.	Food supply.	Sight.	Gravitation.	Heat. Temperature.	Proportion in growth.	Proportion in action.	Nutrition.	Action in separate parts.	Control of proportions.

This schedule directs the pupil to observe in a methodical manner so that he may first receive sensory impressions by sight and feeling in his observations. Next, processes of thought and the methodical interaction of the impressions received are guided, leading to mental comparison. The field of thought and observation is now extended, by the directions to include the conditions around and the action of external agents. Finally, the schedule directs observing and studying living action under the effects of

the environment, and exercises all the mental powers of the pupil.

Space will not allow me to enter into the details of systematic teaching here. I present this plan of schedule in illustration of modes of study that I have followed, and which you may use in child-study.¹

A few examples will be given:—

Specimen I. Peas are inanimate or still objects; let the pupil select one, then measure it every way with his fingers and feel its weight. All measurements are the same, it presents no separate parts.

Specimen II. Take a French bean, there are two ends, two surfaces, and the margin; it is longer than broad, and broader than thick, thus it is longer than thick. It is heavier than a pea.

Specimen III. A seedling pea sprouted in damp moss; it has grown and shows new parts. There is a seed case, and inside there are two cotyledons; also the root and the stem. Measurement and comparison show the root longer than the stem, the cotyledons have not grown; the stem is arched, the concave side is shorter.

¹ See author's "Mental Faculty." The Macmillan Company.

CHAPTER IX

THE NERVE CENTRES IN INFANCY, SCHOOL LIFE, AND ADOLESCENCE ; THEIR HEALTH AND TRAINING

THE nerve system of the child is growing rapidly during the early years. Much depends upon the care taken to nourish the brain and cultivate it during the periods of development, as they pass from stage to stage, through infancy and childhood up to adolescence. Remember always that the brain grows with the body, the well-being of the child depends on each, the body and the brain react upon one another in promoting growth and healthiness ; while the brain health may be cultivated through the senses by controlling the influences that act upon the child from without. The brain is not only growing, it develops as a leaf bud develops ; new parts are forming, it receives many impressions which effect results in building up its structure and organisation. Whether at home, or in the school, or in the streets, traces of the brain activities effected through the hours of each day are in part retained ; and the education received — good or bad — lays a foundation for the future response of the brain under various circumstances.

In healthy infancy spontaneity and frequent spread-

ing movements, representing activity in the brain, are to be encouraged by at times playing with the baby. Watch the growth of the head and the soft fontanelle, where you feel the brain pulsating with each beat of the heart; if this fails then there is something wrong with the child's health, due to defective feeding, mismanagement, or other cause, and the brain becomes less active in growth and movements. Brain healthiness is promoted by encouraging its natural modes of activity, and equally by such organised occupations of children as cause a healthy interaction among the nerve centres. When the child enters school there is a great change in his environment. It becomes necessary to train the child that he may learn, also to produce capacity for coördinated action, that under control impressions may be produced, retained, and repeated in due order. Speech and retentiveness must be cultivated. Allow the child ample time for spontaneous play. Children are naturally sociable and like one another's society; they also like to be guided, if it is done wisely; the child gets tired of being left too much alone.

Do not expect the child to do more either in the kind or in the quantity of work than his present capacity allows; you should therefore analyse the occupations and the methods of teaching you propose to use, so as to proceed stage by stage with your training and teaching. Take as an example School Shop, from an educational point of view : do not expect the pupil to know

how to buy with real money till he knows the coins and understands that they have a real value. He should learn about money stage by stage; for this purpose he must be trained to look at and name colours, to feel and compare weights, to measure size with his fingers, and to feel the margins and the surface of the coins as well as to look at them. He must learn to separate what he sees from what he feels, and to distinguish weight from size. It is not easy at first to make a child understand that a parcel containing a pound of tea weighs as much as a pound weight of iron that he feels in his hand; he gains the knowledge by experience, perhaps verbal explanations do not help him greatly. Much previous training in the general characters of brain action is needed here to prepare the child for mental processes acting regularly, without disorder or extra work other than that called for by the guidance of your directions; if previous brain training has been neglected, mental confusion (not understanding) is likely soon to weary his brain.

We all want our mental processes to be accurate, and the methods of teaching should be exact, but not too mechanical. Let there be a plan of procedure; but while training the brain through sensory impressions, whether for movements, the use of words, or in comparing and thinking, let there be some opportunity the while for spontaneous action and thought. A little extra movement, or a few extra thoughts not quite under guidance,

may do no harm, but lead to a better understanding; they need not always be suppressed; they are like the spreading area of facial expression of intelligence, gentle and undefinable, that may be seen when a question is asked and understood, pleasing to look at, and it may be more indicative of attention and appreciation than any response in words. Thus, while training the brain by sensory impressions for modes of motor action, use of words, etc., let there be some opportunities for spontaneous action of the nerve centres. Children will talk at home of their difficulties in class, the points they do not understand, and what they say was not explained to them, saying how they wanted to ask questions; sometimes the pupils criticise the teacher and the teaching, and complain that they are told "they ought to understand." It would be interesting if intelligent persons could describe their own early difficulties and analyse them, so as to see what was lacking; whether their teacher tried to connect ideas that did not exist in their heads, or used words that had no meaning to them at the time.

Mental aptitude, or the potentialities for mental training, are indicated in a child in whom we observe spontaneity of action, easily controlled through the senses and regulated by impressions received; spontaneity of movement, liveliness in facial expression, talkativeness, with capacity to follow organised games and occupations, are all hopeful signs.

Spontaneous brain action is the basis of mental power. In the infant at birth, as in the adult during quiescent states, the respiratory movements occur in a uniform series. While the child is awake spontaneous movements are seen in the limbs, especially in the small parts, the fingers and toes, but they occur in no apparent order, and are not uniform in character; further, they are not controlled by the senses. Spreading area of brain action is seen in movements when the child cries. When three months old some control of these movements may be seen as the child is impressed by sight or sound; this is the earliest manifestation of potentiality for mental action; still, there is no delayed expression of impressions received and no act of choice is observed.

At birth no signs of mental attention are seen; the infant shows many spontaneous movements corresponding to spontaneous action in many brain centres, but these are not controllable through the senses. Later in the evolution of the infant this spontaneity may be momentarily arrested by impressions received through the organs of sense. Show the infant a coloured object and coördinated action follows; spontaneity of movement is quelled for a few seconds, then the object is grasped by a prehensile action. During the period of quiescence there is said to be an act of attention followed by adapted action. The brain processes during the quiescence appear to be

readjustments of the brain centres which are expressed by the adapted act of prehension. The physiologist cannot admit that the will thus arranges the brain; this act of attention results from the sight of the object. The brain conditions necessary to an act of attention are (1) healthiness in the general characters of the brain, (2) spontaneity, and (3) control of the brain by impressions through the senses, as shown by inhibition and the coördinated action following. Attention, as a physiological process, is inferred to be action among the brain centres, and may occur with or without subsequent expression.

The school child must be tolerably quiet before he will think connectedly. A pause for thought is required in thinking over the answer to a question; there may be an expression indicating understanding without any verbal response. Sometimes attention is best arrested by sight only; other children may be more easily impressed by hearing the spoken word.

In cultivating the faculty of attention we need spontaneity in the brain as the foundation of mental power; we must produce some impression on the brain, and for the sake of exactness and simplicity in training a slight impression through one sense organ only is at first advisable; this is especially the case with difficult children. The impress must be distinctly produced before a full act of attention can follow; the object must be looked at for some sec-

onds before it is completely seen, as, for example, the figure in a proposition of Euclid; hence, irregular eye-movements may interfere with attention. (See Chapter II., p. 33.) An excess of spontaneous brain action and any spreading area of activity, such as corresponds to a number of disconnected thoughts, may be indicated by a number of extra movements, or fidgeting, with vague disjointed response in place of the signs of attention. This is often observable with the signs of fatigue in restless movements of the eyes, the fingers, and the feet.

The subject of mental fatigue has been investigated by many accurate observers on experimental lines. At one period a great deal was said on "over pressure," sometimes, I venture to think, without sufficient analysis of the many causes which may produce exhaustion. Weariness may be due to many circumstances; much might be said as to the effects of muscular exercise, ventilation, diet, conditions of the blood and of the circulation, etc. (See Chapter VI., p. 120.) But I wish here to keep as closely as possible to the consideration of brain conditions leading to fatigue and exhaustion. The signs of brain fatigue are easily observable in the movement and balance of the parts of the body, especially as seen in the face, the eyes, and in finger action. When the brain is fatigued, the force expended in movements is small in amount, and the total number of

movements may be lessened; while action in the child is less easily and regularly controlled through the senses. At the same time a certain number of irregular movements, spontaneous, or not stimulated by your directions, may occur, suggesting that the fatigued child is reduced to a more childish condition of spontaneity than when his brain is fresh and healthy; thus the eyes may often move in the horizontal direction uncontrolled by sight or sound, or the fingers may twitch as he holds his pen, or when the hands are held out and he fidgets without doing his work. Loss of force or nerve tone is indicated by the lessening of facial expression, fulness or bagginess under the eyes, to which may be added spontaneous knitting of the eyebrows (corrugation). The hands when held out free in front are usually at an unequal level and the fingers droop, while the head may drop to one side and the shoulders be unequally balanced. In such a child all movement in response is slow and inaccurate, as well as the speech and the signs of mental action.

The chief means of preventing exhaustion lie in the early recognition of the signs of fatigue. The indications of commencing brain fatigue may appear, either in slowness and inaccuracy of mental response, or in the physical signs seen in the face and in movements as described. It is quite possible for a trained pupil showing considerable signs of brain fatigue to continue

good mental work,—as, for instance, during an examination,—but there is peril in prolonged periods of brain fatigue without recreation. I will not say that fatigue is always to be avoided; but the day's fatigue should be recruited by the night's rest.

The term mental fatigue is used to express the amount of brain energy spent in mental processes. Fatigue results from work done among the brain cells; thus, if the pupil hears, understands, and retains impressions from your teaching, or when he works out a sum or writes an essay, work is performed by the brain centres as each mental act is performed. The physiological energy spent among the nerve cells cannot be estimated by the value which we, as educated persons, put upon the usefulness of the action.

It may be doubted whether we can determine the quantity of mental action occurring in a given time, or whether any unit for quantitative comparison exists; this cannot be represented by the value of the work done. It is only the portion of mental action which is expressed that we can estimate quantitatively, not the quantity of brain action; many thoughts may arise and be inhibited in the brain and so not expressed; in some difficult processes of thinking this occurs to a large extent, especially in original work and in thinking out cause and effect, or in seeking illustrative examples. The time and the order of succession and coupling of mental acts has more to do with the character

of mental processes than the quantity of brain energy expended.

Thoughts of real value, like actions, depend on their coördination by circumstances, not upon the degree of brain work expended. Estimation of the value of intellectual acts differs in the child and adult so greatly as to make comparison difficult; they may, however, be more easily contrasted; in the child the impressions retained are less exact than in the adult, while spontaneity is more abundant, and may interfere with any established order of thoughts. Spontaneous thoughts mean brain work and add to mental fatigue. Effective training tends to lessen fatigue and strengthens the brain for future work. Children who have but few established modes of thought, but many spontaneous thinkings, may become exhausted by their own imaginations; this not uncommonly occurs with lonely, unoccupied children.

A boy who has not acquired the habit of keeping a memorandum of the lessons to be prepared at home is worried from having forgotten some of the books wanted; his master does not trouble his memory, but keeps a memorandum of the class subjects for each day. The boy may think the most about the lessons, but the master is more methodical, and gives the pupil an imposition to quicken his memory. I think the girls in English high schools have too many written-out exercises to do at home.

From the point of view of mental hygiene, attention and mental confusion may be contrasted, together with the means of cultivating the former and avoiding the latter.

In making observations for the purpose of determining the modes of brain action corresponding to a mental act of attention, we must directly observe the motor expressions in the child.

Spontaneous movement is equally characteristic of young animals and young children. A dog going out for a walk with his master evinces his joy in spontaneity by running in the field and making ever wider circles or ellipses; he may return to his master and then recommence his career, till, seeing a cow, he barks at her, but is again recalled by his master's voice; at length he runs at the cow and teases her.

Spontaneous action is here the primary mode of energy displayed, it becomes controlled and coördinated partly by the master's voice, in part by sight of the cow; these controlling forces act in different proportion.

Similar spontaneous action in the cellular structure of plants produces those organised movements which minister to the needs of seedlings. Charles Darwin has described the movements of the root of a seedling wandering in ellipses, though slowly as compared with spontaneous movement in a child. If the root presses against a stone the apex moves away from the obstruction, but bends towards any crevice in the soil and

into the dampest parts. The little root is constantly moving, and is sensitive to touch and to dampness, which guide its action to its advantage by controlling spontaneous action in its cell growth. (See Darwin on "Movements of Plants," pp. 420, 427.)

The modes of brain action may not be sufficiently well balanced, or proportioned, at the stage of evolution of the child, to allow of uniform or prolonged attention. A pupil may at times show marked mental confusion and make an absurd reply to a question. This may arise from several causes.

1. When a spreading area of spontaneous action in the brain is indicated by fidgeting while the child turns his head and his fingers twitch, he may ejaculate words irrelevant to your question; yet thoughts may be arising, though not under your direction; still, all thinkings are of value. Such spreading and spontaneous brain action should not be entirely suppressed, but show that further training is needed.

2. Eye-movements must be educated in order that the impressions received by the brain may be exact. When a child is working an addition sum, as the eyes move to successive figures in a column an extra or lateral eye-movement may bring into view the wrong figure and lead to confusion. (Training eye-movements, see Chapter VII., p. 145.)

3. In reading, eye-movements may similarly bring the wrong line into view.

4. In writing, the pupil may copy the line above in place of continuing his exercise.

5. Confusion may arise from the question being only partially heard, as from deafness; if the child be also short sighted his difficulties are greatly increased in receiving teaching by demonstration.

6. Rapid action of the heart with a quick pulse is common in nervous children, and may be accompanied by other conditions of importance to health. Such disturbance of the circulation may produce marked mental confusion.¹

7. Sometimes an answer is irrelevant to the question put, yet contains the reply to a former question, as to which a train of thought has continued. Such delayed expression of thought is not a mindless condition, but shows an untrained mode of mental action. Brain training may do much to prevent mental confusion and increase the power of attention.

Memory depends upon reactivity of the impressions previously made upon the brain, these impressions returning in activity as a series in the same order as that in which they were produced originally. Thus, the child, when directed to do so, repeats the numerals in their order of succession as previously taught. This — as a matter of physiological action — depends upon the (cohesion) exactness of the impressions retained, and upon the adhesion of those impressions, so that

energy flows along the prearranged nerve paths from the brain centre stimulated by your direction to repeat the lesson, to those centres which were impressed in succession by previous teaching. Such forms of speech and of memory remind us of the exact reproduction of a speech on a phonograph, where the dents made on the wax are retained, and reproduce in their former order the vibrations causing sound, without vibration or adaptability — no interaction occurs among the impressions on the wax.

Overtaxing the memory and producing too many fixed impressions may to a certain extent lessen mental adaptability, and while fixing a certain number of ideas limit free mental power. The same thing is seen in regard to movements ; military drill produces precision and quickness for some kinds of action, rather than adaptiveness and grace of movement under varying circumstances.

A boy when riding is thrown from his horse; a permanent mental impression remains, and ever after recurs at the sight of his saddle-horse : such impression did not occur on commencing his ride before the accident. This exemplifies a very firm act of the memory.

A strong mental impression may be made without any accompanying outward expression at the time. Take an example : a man is told that he cannot live another year on account of some disease. He may sit quite still as he is told this and make no reply, but the care-

ful observer may see his face grow pale, the respirations quickened and the brows knit, possibly with some depression of the angles of the mouth at the thought of mental distress and suffering to come. His subsequent acts, rather than his present expression, will indicate the strength of the impression made.

Impressionability is not quite the same thing as memory. A reflex action results from some external stimulus, an impression is produced at the moment, but this is not necessarily retained. A sudden flash of light causes reflex contraction of the pupil and closure of the eyelids; but the impression is not registered in the brain and remembered.

At least two different kinds of mental activity are called "memory": (1) the simple reception and retention of an impression, almost without any interaction among brain centres resulting; (2) a more active process in the brain involving both the retention of impressions and their interaction, while certain established modes of brain action supervene corresponding to fixed principles and directions of thought. This implies much the same kind of mental action as what is called "adhesiveness" by Prof. A. Bain. In the simplest act of memory a sensory impress produces a simple reflex mechanism; a question is asked, the answer as formerly taught is repeated; the object is seen, then named. This is often called verbal memory.

This simple form of memory as a mode of brain

action may be cultivated in physical exercises in imitation of your movements; the series is learned by practice, and soon becomes repeated with exactness. (See Chapter VII.) In such training it is of course necessary to use the same precision and accuracy in the order of repetition as you would employ in teaching by words. This mode of memory differs from those required in advanced mental processes, where it is necessary to call up fixed modes of brain action previously established, and arrange impressions received by observation on a fixed plan. Thus the use of the numerals and the methods of counting being established among the acquired brain processes, comparisons may be made and proportions described by the use of numbers. Objects may be classed according to the number of their parts and as to their proportions after the methods used in systematic botany.¹

The higher forms of memory for trains of thought and reasoning demand, among other qualities, the simpler forms of memory.

Different modes of cultivating memory are required according to the pupil's stage of mental development; sometimes simple means must be used for implanting knowledge of the facts learned, while others increase the natural retention and adhesiveness of brain impressions and lead to memory for associated ideas, or, as we may say, a series of mental acts. Thus the

¹ See Catalogue of Examples, "Mental Faculty," pp. 163-212.

mental power of memory may be acquired both to retain impressions in the brain, and also to compare these memories one with another, and class them according to their resemblances and differences. The mental processes of analysis and analogy may then be performed among impressions remembered.

In social life, faces are remembered and associated with a conversation; a boy seeing his master may remember some forgotten duty; the surgeon recognises a patient by the scar left after operation, and recalls all the details of the case. Some persons can remember trains of argument better than isolated facts and names.

Defect of memory or forgetfulness may be due to the causes of mental confusion. The original impressions may not have been sufficiently clear and exact; then it may be well in training to produce analogous impressions through the eye, the ear, and by muscle sense. Thus each numeral may be taught as a word separately, while the child looking at your face imitates your pronunciation; then appreciation of number may be taught by seeing together a number of objects corresponding to the numeral, as beads upon a frame; and again by hand movements in pointing with the finger, or by eye-movements as in counting at sight several objects placed some distance apart. After this the numerals may be repeated in order and thus connected as a series.

Reversion to childish states of brain and breakdown in mental health under stress of circumstances may produce grave mental disabilities.¹ The general characters of the brain are very different in the degree of their development in infancy and at ten years of age; during infancy spontaneity in movement is the chief characteristic. This mode of brain action becomes gradually organised under good training so that its functions are adapted by impressions through the senses. In the adult, spontaneity of the brain centres during health is expressed rather in thoughts than in movements, and much of the motor action is seen in small movements, well controlled; as in the tongue and face in speaking, and the fingers in writing, each expressing mental action. If we look at examples in the stages of infancy, early youth, and full development, we should find movement displayed at each successive stage, but with some differences in the proportion of motor action to the amount of brain energy expended in the process of thought (psychosis); this proportion represents an interesting and important change of function during brain evolution.

Reversion among animals and plants is the tendency sometimes manifested to assume the modes of growth or habits of some ancestor; such reversions are especially apt to occur under conditions of low health and diminished nutrition.

¹ Reference 49.

In school children and in adults reversion to a "childish condition" is not uncommon. After mental fatigue and when needing food, a child may become almost infantile in his peevishness and irritability with want of capacity for control; his utterances are disjointed, his movements fidgety, and sometimes hardly enough under control even to take his meal. (See Chapter V., p. 101.) The child presents much spontaneous incoördinated movement like a baby, and is not guided by his surroundings, and therefore is inharmonious with his environment. Rest, feeding, and sleep recreate his brain power and restore a placid and active mental status.

Reversion occurs in mental action when a former thought or series of thoughts arises; old thoughts revert to activity in dreams, in delirium, as wild thoughts which rush through the brain in times of weakness. Return of thoughts depends upon the reactivity of certain brain centres; the process of recalling thoughts has been considered in speaking of voluntary power.

The reactivity of past thoughts is by no means simply due to spontaneous action in the brain. Sight of certain objects, old letters, written words, and books may revive former thoughts, long absent.

Thoughts altogether spontaneous resemble the modes of brain action evinced in spontaneous bodily movements, such as are seen in the poorly nourished

brain of the patient ill with fever, who in his delirium ejaculates words and picks the bedclothes with his fingers.¹

The revival of former thoughts often replaces the activity of those of recent date; this corresponds to the inactivity of recent impressions, or, it may be, to their dissolution. Replacement of thoughts implies probably in many instances dissolution of existing unions of nerve cells, the nerve paths which connected them having disappeared, thus setting the nerve cells free to enter into new combinations. In a brain with healthy activity, reversion of spontaneity during a period of rest may lead to the dissolution of a line of thoughts, resulting in greater freedom either for the reception of new impressions or the revival of former ones. The writer lays aside his work and observes those around him, or joins in general conversation.

¹ Reversion in illness. See "Anatomy of Movement," Chapter III.

CHAPTER X

MENTAL HYGIENE AND VOLUNTARY MENTAL POWER

MENTAL action as a physiological process occurring in the brain (psychosis) is known to us only by inference from our observation of its expression. We all know that mental action may take place without immediate expression; we believe that many thoughts occur in children's heads that are not expressed; hence much trouble has been taken by many workers in child-study to get at the contents of their minds. Mental processes leading to expression are capable of observation; we find in childhood mental healthiness and aptitude or mental disorderliness and inaptitude. These subjects for inquiry may be pursued on the principles laid down in studying the visible characters of brain action, and afford a basis of mental hygiene which may be followed after the methods of other natural sciences by observation, description, analysis, and inference, leading to generalisations from experience. (See Chapter V., p. 103.)

A large field for observation and study is thus opened up as supplemental and co-relative to the physiological aspect of mental training and school life; while school hygiene, in its purely physical as-

pects, deals with health culture and the prevention of disease. Among other sections of mental hygiene¹ we may study:—

Mental aptitudes and mental disabilities; or causes of mental dulness in children. (See Chapter III.)

Mental weariness and brain fatigue.

Mental confusion and observed concomitant conditions. (See Chapter I., p. 15.)

Defects of memory and the means of removing them.

Reversion in mental status and childish faults. (See Chapter IX., p. 191.)

Mental breakdown at adolescence, and its connection with previous training.

Mental aptitude, or the capacity for mental training, is indicated in a child in whom we observe spontaneity of action easily controlled through the senses and regulated by impressions received; much spontaneous action, liveliness of facial expression, talkativeness, with capacity to follow organised games and occupations, are hopeful signs. When these are accompanied by good imitative power in action and in speech, with retention of what has been acquired, and increasingly exact repetition after practice, the indications of educable brain power are distinctly present. The cultivation of each individual sign of such aptitude, first

¹ I here quote from my recent article contributed to the *Lancet*. London, April 29, 1899.

separately, then collectively, may be advisable; this is specially the case where one item is deficient, as, for example, where some form of spontaneity is not easily coördinated, it may be restless eye-movements or finger twitches, which lead to incorrect observation and poor manipulative ability. These points I have described in detail. (See Chapter III.)

Mental hygiene, as a science, demands some knowledge of the physiological action occurring in the brain during various mental processes, as well as appreciation of the general status of the pupil's brain in which such action is observed. The special modes of action observed may be satisfactory or disorderly; while the status of his brain is indicated by its general characters as being normal or subnormal.

Will and the power of volition are foundations of character. The term "voluntary power" is convenient as a label for a certain kind of action of which we all know something. As I do not admit, for the purposes of scientific investigation, that consciousness and volition are causes of visible action, it will be necessary to trace the processes occurring in the brain (psychosis) corresponding to what is commonly and conveniently termed voluntary power or action, and also to study and become familiar with their modes of expression.

Various modes of voluntary action may be analysed as to their expression, and the brain action corresponding may be inferred. Actions admitted to be volun-

tary may be contrasted with others which are clearly involuntary. Examples of children may be considered in whom volitional power is seen, and contrasted with others in whom it is absent or but slightly marked.

Voluntary action may be motor or mental; the child may do something to please you, or he may keep quiet for a minute to think what he ought to do next and how to set about it. When a physical exercise is performed as a series of movements, following a command but without further direction, motor voluntary action is seen. When the pupil reads his lesson, persistently suppressing all thoughts that arise other than those guided by the book, voluntary mental power is exerted. The boy may think out some "reason why" in his head, without looking at book or paper and without visible expression in action.

Voluntary action is mostly an expression of antecedent brain impressions reviving to activity and interacting among themselves, independent of present guidance. It seems to depend upon brain organisation, evolved or built up by training, as well as upon some spontaneity; there is a revival to an active state of previous impressions acquired which become arranged in an orderly manner, and interact and control one another after modes previously established. (See Chapter VIII., p. 171.)

Voluntary power is in great part dependent upon the **general characters of brain action** previously acquired, as well as upon experience. (See Chapter II.)

Spontaneity plays a part in voluntary action ; occurring independently of present stimulation or guidance, activity in the brain centres originates the action without impress through the senses. The boy, having completed his exercise, gets up, without direction, and puts away his books. Again, spontaneity may interfere with what we call voluntary action, seen in extra movements and fidgetiness, or disconnected thoughts arise in the brain through the want of control and guidance.

Impressionability of the brain in various forms is necessary to the acquisition of voluntary power ; but, during purely voluntary thought, it is the interaction going on among the brain centres, independent of external stimulus, that characterises the mode of action. In fact, if there be much impression by the environment, this is opposed to purely voluntary self-control.

Inhibition. — We speak of “concentrating the attention” in voluntary thinking. Among other points this signifies inhibition of spontaneous movements as well as thoughts arising which are not connected with (adherent to) those in the direct line of thought. This inhibition in physiological action is produced by the activity of the brain centres corresponding to a dominant established principle, or a previous direction. Inhibition is the faculty continuously exerted by the primary impression or direction of thought in preventing action of the brain centres arising spontaneously from sending out force to the muscles producing ex-

pression. Then the centres act among themselves by their nerve paths, and those that have often been connected before are reassociated as formerly; thoughts become arranged and connected, making a plan for action. The child is quiet for a moment, thinking out his sentence, then he writes it down; during thought, certain nerve centres become temporarily connected for action in a certain order and remain active, while the others, not stimulated by the "dominant idea," subside into inactivity. Exercise of the will in suppressing spontaneous thoughts that arise leads after a time to the visible signs of fatigue, showing that the mental effort corresponds to physical brain action. Once acquired, the habit of inhibition by the employment of established principles and directions saves much fatigue in the future. (See Chapter VII., p. 155.)

Control through the senses and by muscle sense in training does much to cultivate voluntary power. The impressions made on the brain must be definite and exact, not merely the impress of words. Directions (verbal) should be precise, and where possible should correspond to and be coupled with physical impressions; thus they become more permanent than directions merely verbal. For the purpose of cultivating voluntary power in estimating proportion — and indirectly the value of things — training should be practised with weights in the hands, say, one-half, one, two ounces, and the names and numbers expressing these

weights should be connected with the proportion of muscle tension resulting from holding them; thus proportional impressions are received in the pupil's brain, and a standard for comparison is impressed and retained which may revive in voluntary action. (See Chapter VII., p. 155.) A scale or standard of measurement may be established in the brain by practice in estimating the length of horizontal lines drawn on the blackboard and others placed vertically by means of the eye-movements; or the length of sticks by measurement with the hands. In each case physical effects of proportional action are produced which may be coupled with terms of expression, and used in forming a voluntary judgment in other matters.

Some faculty for voluntary processes of thought and comparison is thus implanted in the child's brain. Many of the modes of action that need training through sensory impressions might be described. The results of training, when established, easily revive to activity, following a single dominant thought or direction from the teacher. The directions employed in previous teaching, if firmly retained after practice, may, like physical impressions, be easily revived to activity, and take part in brain action during processes of voluntary or self-contained thinking.

Thus the brain, acting under a single direction or dominant thought, and without receiving present impressions from without, may be the seat of reviving

sensory impressions coupled in succession with the terms of direction; the nerve centres in the brain that have been trained or coördinated react one after another, and they become arranged in order for expression. After thinking what to do, or what to write, a long series of connected acts or a written paragraph may follow. This result can only be obtained after training and practice.

Established modes of brain action are needed, such as methods of procedure, *e.g.* methods of examining flowers as taught by the use of a schedule (see Chapter VIII., p. 172); the use of numbers to be coupled with things or acts; modes of noting and describing the order of events and their sequences; standards of comparison and expression for numbers, weight, measurement of length, surface, volume; modes of estimating ratio and proportion, and their expression.

All these modes of action in the brain come into useful employment. Voluntary action in home lessons is not necessarily produced under immediate and present continued guidance of a teacher, as it is in class teaching. Preparation work affords some opportunity for spontaneity; the inaccuracies may show the teacher in what particulars the class teaching has failed with the individual pupil to produce one particular mode of procedure. In so far as the pupil's action is self-contained, and not dependent upon guidance, it is spontaneous; while, as the result of previous training,

brain organisation has been built up and leads to the action of one established act or mode of procedure after another.

Coördination.—I think it will be found by teachers that the pupils well trained in all the general characters of brain action, by means of physical exercises and in particular in coördinated movements, acquire the modes of voluntary power better and more easily than others in whom such training has been neglected. From what has been said it follows that class work under guidance trains method and gives exactness; while voluntary work at home cultivates the coördination of spontaneous mental activity. Voluntary co-ordinated action has a foundation in spontaneity trained to orderly procedure.

Spreading brain action may interfere with steady volitional power. A butterfly comes in at the window, the sight controls all the boy's action as he chases it. The impression of want of food is felt, and the lesson is forgotten. The thought of the playground occurs, and the game is followed in imagination. But spreading brain action may be started by some portion of the lesson. When writing the description of a pea-flower, in place of following the directions of the schedule the child may think, "Why do insects visit the flowers?" then he thinks of the butterflies and how they fly, and that the wings of the insect look like the alæ of the (papilionaceous) flower, so he loses

time and does not write a good exercise—but he thinks.

Such wandering thoughts in the pupil are not well coördinated voluntary action; but if this spreading area of thought can be guided, the process may become useful. The boy at his Euclid may give a different demonstration to that he has been taught. Spreading area of thought is necessary in finding an illustrative example for an essay; many arise, one is selected as being in harmony with the subject in hand.

Response may be delayed, yet the action may be voluntary; the fact of an interval between direction and response, when the action required is complicated and in no way a repetition of the direction, may be looked upon as a voluntary intelligent act. “Direction—dissect the parts of that plant and arrange them for demonstration.” There may be an interval during the period of thinking how to begin; then the work proceeds stage by stage without further guidance and is recognised as intelligent and voluntary.

We may now briefly trace the evolution of the signs of voluntary power from infancy. At birth the infant does not show evidence of voluntary power; certain reflex actions occur, and a spreading area of movement is seen in crying; spontaneous movements indicate much separate action of the various brain centres, with but little impressionability and little

power of control. At about four months old sensory impressions are followed by momentary inhibition of movement, and a little later, such control is followed by some coördinated act, as the object shown is grasped. As yet we see no indication of anything that can properly be called a voluntary action depending upon the interaction of impressions received.

A few months later, but before the acquisition of speech, choice may be made between two objects presented; one only is taken hold of, or if both are grasped, one is dropped, and the other retained. One impression by sight proves stronger than the other; this is perhaps the earliest kind of action that can be termed voluntary — there is interaction among the brain centres, and the stronger impression is expressed in action.

Various kinds of action in a child are characterised as voluntary, such as action following a word of command; complex series of acts adapted by the environment, and therefore in harmony with it, controlled through the eye, the ear, or by the muscle sense; also well-adapted speech. Volitional action usually depends upon antecedent impressions, associated and adherent, as well as upon some spontaneity bringing them into activity.

Many modes of brain action are contributory to voluntary power following experience and practice in tracing out the order of observations and events, or the

cause and effect. In such mental processes there is interaction among brain centres, not under present guidance from the outside, yet capable of impressionability. Many brain impressions spontaneously recurring to an active condition become arranged and rearranged according to their adhesiveness, as in processes of comparison and classification.

Choice and comparison are examples of voluntary power; the former is simple, the latter needs cultivation in many ways, each of which must be trained. (See Chapters I., p. 14; VII., p. 155.) Simple comparison may be made as to agreement or difference, among objects seen or others previously observed, in the degree of the weight of each, in the impressions received (by muscle sense) in measurement; in either case it is the impressions made in the pupil's brain that are compared, and these, when revived to activity, may lead to comparison and an expression of proportion, as he writes a description of what he has seen and what he thinks. In teaching habits of observation, each physical impression made through the senses should be exact and definite. The pupil's description of his observations in class may be written as a home lesson; there will be a pause sometimes in his writing, for the revival of the impressions previously received; mistakes may occur from not having received firm impressions in class coupled with the terms of description. These periods of stopping to think may be too

prolonged; both physical and mental training may quicken all the general modes of brain action, and improve the mental processes.

The general modes of brain action all come into play in establishing voluntary power; they interact in various ways. In the school child who has acquired orderly habits under training, certain modes of action are established; groups of brain centres have been so far connected by nerve paths that they tend to act in a fixed order.

Common examples of established modes of action may be mentioned: the salute on meeting teacher is an acquired habit; names of classmates are known; the numerals and the methods of counting have been learned; experience has been gained of a bad mark for late attendance; the names and sight of buns and cake for lunch have been retained. The boy entering the schoolroom before work begins recognises the master, then proceeds to count his fellow pupils present by their names without giving expression, names the rest to himself as being likely to receive a bad mark, thinks of his lunch and selects cake for his penny. Former impressions interact with those produced through his senses in such voluntary thinking as is indicated.

The voluntary character of action does not so much depend upon the order of acts and thoughts, and their arrangement, as upon their independence of

present stimulus or guidance from the outside; voluntary thoughts may be sequential or disconnected, but are usually related to certain antecedents.

Coördinated action is characterised by relations in the time and order of individual acts, and the degree of each act being in due proportion; this may take place under control of the present environment or be established as a fixed mode of brain action following from practice.

Intellectual action is indicated mainly by the order in which the thoughts are expressed. Voluntary intellectual power is the highest attainment to be cultivated.

We speak of (1) voluntary motor action, (2) voluntary thinking without expression, (3) voluntary thought and its expression. In giving illustrations each mode of voluntary power may be exemplified, as they are much associated.

Direct the child to write a description of what he did during the previous day. He sits down to his work and remains quiet for a while, thinking; the impression of the direction is followed in his brain action by revival of the visual and auditory impressions previously received; these, then, adhere in the order of their succession, showing that the order of their reception was retained. Many points which produced but little impression are omitted from his description, such as getting up and going to bed. His own

thoughts are hardly indicated, school teaching is not referred to; but points in home life and at play, as well as what he saw in the streets and the shops, are described.

It may be said that obedience should be voluntary and prompt; perhaps it is more prompt in school, and though less exact and quick, more voluntary in the home.

A boy after school is asked to go skating. The word skating is followed in his mental action by the revived activity of impressions formerly made in his brain; also other impressions experienced revive: the direction of his father to come straight home after school; the impression of the dinner which will not wait for him, and the story book at home—all these impressions become active; father's directions, dinner, story book, adhere as a series in his brain, together with a former experience of the ice breaking on the pond. Experience aids voluntary power. Impressions (verbal) of the abstract principles of obedience and duty do not arise till, after walking home, he sees his mother. The boy's conduct, which we call voluntary, depended upon many previous impressions revived in his brain which recurred in a series, as the effect of training these controlled his action when no words of direction were heard.

Voluntary action, as thus illustrated, occurs in the healthy brain which, under experience and training,

has received and retained a number of fixed impressions, but they must be definite physical impressions, not merely produced by words. These are represented in the brain by groups of nerve cells tending to act together (diatactic unions), and they are connected by nerve paths with other such groups, so that energy habitually tends to flow in fixed directions, even when no sensory stimulus is acting. It is mainly the interaction of such groups of nerve cells formed by sensory impressions that leads to the earlier manifestations of voluntary power.

I cannot define "volition" and "will" in physiological terms, but we may trace the modes of brain action which lead to voluntary power and thought. The general characters of healthy brain action all help: groups of brain cells in the highest parts of the brain (the cortex) in their activity correspond to thoughts; these when active may be coördinated or controlled by sight and by the sound of words previously familiar.

Impressions thus arising spontaneously, or produced through the senses on the brain, may adhere by the formation of nerve paths, so as to occur after practice in the order in which they were established.

The impressions made by your directions, often repeated, may similarly revive and become connected in the child's head, and guide his thinking when he is alone. Capacity for choice, mental comparison, and

established modes of (logical) thinking may evolve in such processes. Thus spontaneity may bring into activity former deeply implanted impressions and guide thoughts aright. On the other hand, if no impressions have been firmly fixed in previous teaching, spontaneity may upset all loosely connected thoughts, and nothing that can be called voluntary power is manifested. The best lines of voluntary power follow from well-established mental impressions interacting under the influence of the environment.

Take the case of preparation of lessons at home for the next day; it seems to me that they should be taught in class and expressed in the home work, to exercise voluntary power and allow of some exercise of spontaneity. In class discipline the work is done under the teacher's observation and guidance; at home the child works alone, or at any rate it is to be hoped in quietness, with the help of a time-table and the directions previously received, so that self-guidance comes into play.

Training is effected by producing impressions on the nerve centres of the brain through the senses; various concomitants may result from your endeavours, the mental processes you produce may be exact but accompanied by extra brain action, or the pupil's response may be a simple reproduction of what he had heard before, in place of showing voluntary brain power. It is desirable to know the general characters

of the brain upon which you propose to act and to watch the processes that occur in it, not only the effects produced by the teaching in ourselves. You need to cultivate various capacities in the pupil's brain, giving facility to the nerve centres for interaction and adhesion under the influence of a fixed direction, also for the reactivity of former directions received and retained, which reviving assist the brain processes. Systematic teaching, long continued, tends to cultivate certain forms of self-government or voluntary power.

In cultivating voluntary power distinct sensory impressions are to be produced by various adaptations of your method. The order of associated impressions is important, and tends to be retained in the brain, while it is strengthened by repetition; coördination trained by physical exercises will cultivate this mental faculty. Associated impressions when firmly retained revive in the same connection as a form of self-contained action. Retention of the order in which the pupil has made his observations has much to do with his logical thinking, and understanding antecedents and sequents, or cause and effect. Retention of the order of the numerals and of the weights compared and expressed by use of the numerals is necessary to mental estimation of weight, bulk, mass of objects, and also to appreciation of the probable value of quantities of materials seen. The money values

of one pound of tea and ten pounds are in direct proportion to the weight of the shillings expended in their purchase.

Spreading brain area and excess of spontaneity need control in voluntary action; inhibition of spontaneous thought as a self-contained power is cultivated by temporary inhibition of movements in physical training, which is best brought about by action imitated from the teacher in momentary quietness. In voluntary power wandering thoughts can be controlled by recalling directions given, or the dominant thought of the exercise in hand, as during home lessons.

Some children are quick mentally, but "scatter-brained," others are plodding and slow in response. In some, will power is naturally strong with persistent self-contained purpose; while others are docile, but seem to have no fixed ideas; some reproduce knowledge acquired like a phonograph without any apparent effort, or any secondary thoughts arising. Intellectual faculty is not necessarily accompanied by self-determination, and voluntary action may become almost automatic from constant repetition. Voluntary power is not one brain faculty, but is based on many faculties which need to be balanced in training. The child first learns to make a choice; then we see indications of brain impressions retained, and established modes of brain action; while princi-

ples in thought become evolved, with capacity to recall and retain previous directions in a certain order.

Cultivate the habit of suppressing spontaneous thoughts not associated with the dominant work in hand, while connecting such as arise in harmony with the direction received and previous training and experience; this may be educated by training the general characters of brain action already described, and build up a voluntary power of use in the duties of life.

Volitional power varies with physical health. A good state of general health raises will power; low diet lessens it. A slight degree of lowered nutrition impairs voluntary strength; so may mental fatigue, in which condition spontaneity is apt to supersede it, and if exhaustion supervenes, coördination both mental and motor may be replaced by much disorderliness of brain function.

Voluntary action, when it is independent of strong stimulation, is mainly due to the experience of past impressions in the brain; if these are but few, volitional power is low and quickly fades. A strong exercise of the will in concentrating attention and in acting on fixed principles, even against the distractions of circumstances, involves an amount of real brain effort which can produce the visible signs of fatigue.

Action resulting from strong present stimulation is

sometimes called voluntary: a moth settles on the paper as I write, I carry it to the window and set it free, at once it flies back to the lighted lamp and gets burned. It was not the moth's will, but the light of the lamp that controlled the movements. Certain movements are classed as voluntary; it may be remarked that growth is never said to be voluntary, not even when its results are as wonderful as those producing the most complex actions seen in seedling plants.¹

Certain classes of movements are not called voluntary, such as:—

1. Acts performed during sleep or when other indications of absence of consciousness are observed.

2. Simple reflex actions: as closure of the eyelids when the eyeball is touched. Such acts are uniformly repeated on stimulation, without signs of interaction among the brain centres. (See Chapter IV., p. 75.)

3. Respiratory movements when uniform, as in quiet breathing, are not voluntary, but these may be quickened and altered in their rhythm under emotion.

4. Uniformly repeated movement, such as walking, which is continued under the control of muscle sense without much guidance through the senses.

5. Speech, when merely ejaculatory and disconnected, as in delirium.

6. Movements that appear to be spontaneous,

¹ See "Anatomy of Movement and Modes of Growth," Chapter II. The Macmillan Company.

neither resulting from past impressions reviving to activity nor controlled by present sensory stimulation, such as those of earliest infancy. (See "Reversion of Spontaneity," Chapter IX., p. 191.)

In some children, who may be said to be well trained and obedient, voluntary power is not what it should be; it may be prompt, accurate, uniform upon similar occasions, yet so far mechanical that the individual child is obviously deficient in adaptiveness and want of true self-reliance. Certain fixed modes of brain action have been established and retained; the pupil does as he has been taught to do under certain circumstances apparently voluntarily, at any rate without much guidance, yet under a new set of circumstances he is helpless and has but little power to act for himself. Such a child is wanting in spontaneity and originality through having been too much trained in one direction, leaving him with too little experience of the circumstances of life, and but little freedom of thought, thus suppressing what is healthy in free and spontaneous thinking.

Remember that voluntary mental action may occur and thoughts be correctly formed in the mind without the power of expressing them. This is often found to be the case in children of the nervous type, and in pupils not sufficiently acquainted with the use of language for expression.

A varied environment and circumstances affording opportunities for doing right or wrong in the tempta-

tions of school days take their part in developing character, and afford scope for the good influences that the boys and girls in school may exert over one another. The ideas of honour among schoolmates in play are just as important as the principles taught in class. At the boarding school half holidays out of bounds, and the holidays spent at home, show much of the effects of training and teaching exemplified in conduct when free from restraint.

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